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Concrete.

The use of concrete has evolved itself, so to speak, so widely and with such satisfactory results when under proper engineering direction that many engineers seldom reflect that the material called "concrete" has fully as wide range of application as that termed "steel." By common convention, when an engineer speaks of steel in connection with structural work he is safely assumed to mean structural steel, a material not precisely defined but indicated with sufficient accuracy when taken in connection with that portion of the structure in which it is used.

The general use of steel in engineering work has now covered a sufficient period to develop standard classes of the material, based on essential constituents and corresponding adaptations in the structure. On the other hand, the use of the term concrete by most engineers, and many others interested in structural operations, is such as would be the case with steel if there had been no development in its field into universally adopted classification as to qualities and corresponding uses. There would be demoralizing confusion and fatal misapplications in important members of structures if it were not positively clear just what grade of steel should be employed in each prescribed piece of work. While it is true that in nearly all proposed concrete structures the attempt is made to prescribe the concrete mixture, it is not always done, and in cases where the specifications are written they are all too frequently prepared without any material regard to the purposes of the work. In reality there is no less reason for carefully prescribing the grade of concrete to be used in any particular portion of a structure than there is for indicating the special grade of steel in regard to the duty of the member to be manufactured from it.

Concrete is simply concrete to altogether too many users of it. There is a great range in the duties to be performed, for instance, by the different concrete portions of a modern steel-framed building. If the heavy loads carried by vertical series of columns to a foundation bed are sustained by a concrete-filled caisson, or indeed, by any concrete mass, the needed mixture is clearly one comparatively rich in cement and dense in texture; whereas the concrete arches sprung between steel beams to form the floors may properly be less rich in cement and less dense in texture; that is, less strong and lighter. Again, in those cases where a careful determination of the voids of a graded aggregate justifies the use of a comparatively small amount of cement, the specifications should indicate the imperative necessity of a most thorough mixing. The individuals of a graded aggregate may run in size from the finest sand to 2-in. stone, and, with suitable proportions of the various sizes available, the voids may possibly be reduced to 15 per cent. of the entire mass. If but little excess of cement is employed to fill those voids, far more thorough mixing will be required than for a 3 to 1 mortar, and it should not only be prescribed, but insisted upon. If a relatively small percentage of cement is distributed uniformly throughout the mass, the results will be entirely satisfactory; but if the mixing is incompletely done there will be portions of the mass containing far less cement than intended, which will never attain strength. Similarly the finest portion of the product of a crusher may be advantageously employed in making concrete, and there have even been cases where small amounts of clay have been shown apparently to improve the quality of the final product; but obviously so-called crusher dust should be used under proper conditions, clearly specified as to proportion and treatment so as to produce the maximum results of strength and density.

There are classes of structures in which the function of the concrete is to act chiefly as a mass of sufficient weight to insure equilibrium. A high degree of resistance either in tension or compression is not required for such masses, and a rich concrete, correspondingly expensive, would not be justifiable. A properly graded or balanced aggregate, either from the crusher or of gravel, with a minimum of voids, would best meet the requirements of those conditions, especially if density were also desired. Suitable proportions in this and other cases could scarcely be prescribed prior to the beginning of the work, unless the character of the broken stone or gravel to be used were thoroughly known in advance. If a light product should be demanded, as for the floors of buildings, it may be admissable to use cinder concrete, even with its depreciated resistance.

These observations show the great range in the qualities of concrete within strictly legitimate limits for an equally great range of structural purposes. They indicate, furthermore, that with the same proportions of cement and aggregate greatly varying results will be obtained, according to the grading and character of that aggregate. That being the case, it becomes of the utmost importance to classify concrete or to name it in such a way that it will be perfectly obvious what is meant by the specifications covering concrete for any particular work. A detailed specification concerning the method of preparation may evidently fulfil the requirements of any case, but that procedure may easily be made futile by a local supply of broken stone or gravel of unexpected character.

With the increasing demand for varying grades of concrete for all sorts of purposes, material advantages will be found to result from authorizing the resident engineer to determine and fix suitable proportions for the mixture by experimenting with the most suitable materials offered, the client, and not the contractor, purchasing the cement. There is no substantial reason for the invariable purchase of such a standard manufactured product as cement by the contractor. Any owner can easily make a competitive purchase through his engineer or directly by himself. This procedure properly conducted would eliminate in many cases injurious obscurity, simplify the production of concrete, and lead to the attainment of the best possible results with the greatest economy.

The Operation of Power Plant Auxiliaries.

The warfare between reciprocating engines and steam turbines has been so savage that the onlooker not directly interested in the conflict has probably overlooked the changes of much significance that have been introduced in the auxiliary equipment of central stations. The last word concerning them has not yet been said, and cannot be for some time, but it is possible to indicate certain tendencies. These are mainly the result of the use of superheated steam, although not wholly so, as the rapidly growing favor in which open feed-water heaters are held, to mention a single case, is merely the result of experience with such apparatus in good hands. The open heater made its first great stride into engineering favor when it proved able to remove scale-forming materials from boiler waters. This was a very important achievement, and the counteracting assertion that the open heater allowed oil to enter the feed had little weight with people who knew by experience what really serious troubles could be caused by scale. The results of the presence of oil were a trifle in comparison with the difficulties attending the introduction of cold, hard water into a boiler. The open-heater being thus established in favor, its protection against oil was next studied and various types of separator were introduced to keep oil from the feed. It is believed in some sections of the country that no separator is good for much, and that the use of an open heater, except with hard waters, is likely to cause trouble from the presence of oil in the feed. It must be admitted that users of open heaters laugh at this claim, providing they are the class of people who understand that separators and open heaters require occasional cleaning, like all other apparatus in a power station.

The introduction of superheated steam has had a tendency to hasten another change in power station equipment. Until recently standard practice called uniformly for steam-driven pumps. It was noticed, however, that the cost of electricity at the bus-bars was about the same as the cost of the steam used in these uneconomical steam auxiliaries, and motor-driving has accordingly come into use in some places. In place of expensive steam pipe inexpensive wires are used, and the steam piping of the station as a whole is correspondingly simplified. The boilers are used solely for delivering high pressure steam to the main engines. On the other hand, the steam-driven auxiliaries are independent of any trouble at the bus-bars, and if a storage battery is not required in connection with the main service of the station it is unnecessary to put it in for running the auxiliaries independently of the current from the generators. At this writing it is hard to say whether steam or motor-driven apparatus will prove the more satisfactory, and accurate information on the subject, based on actual experience, will be welcomed by many engineers.

Another most interesting feature of auxiliary apparatus is well shown in the Detroit Edison station, where mechanical draft is employed to supplement, at times of heavy load, the natural draft of pretty high stacks. All good boilers will stand heavy forcing, but the less this is done the better off the plant will be. It has been observed, however, that where the draft must be checked to make it right for normal operation, there is often a tendency to be somewhat careless in the little details of boiler-room management. In the case of such an equipment as that at Detroit, the fact that mechanical draft is available for use when really necessary will doubtless not be allowed to affect the enforcement of any of those precautions taken in stations running solely on natural draft.

Troubles from Interrupted Power Service.

In the numerous papers which have been written of late by engineers connected with hydraulic power plants on the Pacific Coast, mention is often made of the care that is paid to avoiding any interruption of service and the anxiety which this feature of operation often causes the managers of the plants. Another aspect of this subject is presented in a recent decision of the Michigan Supreme Court in a suit brought by the Michigan Paper Co. against the Kalamazoo Valley Electric Co., 104 N. W. Rep. 387. The plaintiff runs a paper mill operated partly by steam and partly by water. The dam furnishing the power is on the Kalamazoo River and some distance below it is a dam belonging to the defendant. During the winter of 1902-03, there was an ice jam in the river between the two dams which prevented the plaintiff from running its wheel and the mill was stopped for some days in consequence. The plaintiff claimed that this jam was the result of the poor design of the defendant's dam, which did not allow slush ice to be flushed away, and was also due to the negligent operation of the plant. The plaintiff won the suit in the trial court and it was carried to the supreme court on an appeal involving points which do not relate so much to engineering matters as to legal obligations. They are nevertheless deserving of mention in this connection. The trial court determined that the defendant did not use reasonable care in preventing the formation of an ice jam and the supreme court has refused to set aside this decision. An attempt was made by the defendant to show that the jam was one of those exceptional results of natural causes which do not warrant the courts in imposing damages, but this contention was also overruled. The amount of the damages was also attacked, because the paper company subsequently filled all its contracts and was therefore not seriously inconvenienced, but the supreme court decides that the shut-down prevented work during a certain period of regular operation and the owners of the plant were entitled to the profits regularly made during this period. The amount involved was not large, but the principle at issue is important and deserves attention.

There are a good many plants of this type where ice may cause trouble to upper riparian developments, and the recent Michigan decision adds a legal importance to the engineering reasons for a careful attention to the handling of ice. Probably there is no single feature of hydraulic power plant work in cold climates which causes so much anxiety as this, and there is plenty of opportunity for improving the conditions in a good many stations. Complaint is sometimes heard that the troubles from ice seem to be increasing. This is probably due to the necessity of running the station more closely up to its full capacity than before, and interruptions are consequently more serious. Whatever the cause may be, the steam auxiliary is becoming an adjunct of many hydraulic stations. Where these stations run fairly uniformly they do not afford much ground for criticism, but where they are likely to be started up in a hurry it may be questioned whether a plant running on producer gas does not offer sufficient advantages to deserve giving it very careful consideration. The noteworthy station to be built by the California Gas & Electric Corporation as a reserve plant for use in case of accident to its hydraulic stations or the transmission lines from them is an example of an equipment which will furnish a class of service beyond the capacity of a steam station. It is an exceptional instance, it is true, but the gas engine and producer afford an insurance against interruption possessing certain marked advantages, which are reviewed at some length on page 372 of this issue.

Punching and Reaming.

Until within a few years the subject of punching and reaming was the cause of frequent and sometimes bitter controversy between engineers and the managers of structural steel shops. It goes without saying that reaming is expensive, and that drilling is more expensive than punching and reaming. Engineers called for drilling in many places where steel workers believed that punching and reaming would answer every purpose; in fact, they were so sure of this that shops would sometimes take work specified to be drilled to an extent wholly beyond the capacity of their drills, unless the process was conducted by some sort of incantation over the punches and reamers. Fortunately these differences of opinion between engineer and steel worker are now almost obliterated, largely through the recognition by the engineer of the good results that can be obtained by the careful use of punches and reamers, and by the manufacturer of the necessity of meeting the requirements of the engineer concerning quality of workmanship. Both have come to recognize that it is a result and not a method of shop practice which is the vital feature of the matter.

These thoughts are suggested by a supplementary report of the committee on iron and steel structures of the American Railway Engineering and Maintenance of Way Association, relating to some comprehensive investigations it made into the effect of punching and reaming. For these tests basic steel was furnished by the Carnegie Steel Co. and acid steel by the Pennsylvania Steel Co.; the samples represented grades averaging 60,000, 65,000 and 70,000 lb. ultimate strength and were from ⅜ to ⅞ in. thick. This material was made up into test specimens with both sheared edges and planed edges with no holes, and with planed edges with a central hole rough punched, sub-punched and reamed, and drilled from the solid. So far as possible there were at least three specimens of each kind. All were 3 in. wide and 16 in. long, and all holes were to be 15-16 in. in diameter. The tests were made gratuitously by the Pittsburgh Testing Laboratory, and its observations on the results were substantially as follows:

With basic steel all sheared specimens began to tear on one edge first and gradually opened until final rupture, giving in many cases a very irregular but silky fracture. All punched specimens showed several openings around the edge of the hole near the fracture, due to the roughness of the hole. The reamed and drilled specimens gave a very gradual pull, while the punched ones broke with a sudden jerk.

All the sheared specimens of acid steel, except those with a granular fracture, showed small openings around the edge of the hole near the fracture, due to the roughnes of the hole. In a few specimens the fracture on one side of the hole was granular and on the other side silky. Several of the ⅝-in and ⅞-in. specimens had a granular fracture, but were clearly of high-grade metal. The reamed and drilled specimens of high-grade steel over ⅝ in. in thickness invariably broke with a granular fracture and a sharp, snappy report. The material was all rolled in a universal mill, and the Pennsylvania Steel Co. stated that if narrow flats rolled on grooved rolls had been used the results would have been more uniform, for its experience is that the wider the plates are made the greater is the variation in tensile strength.

As a result of the investigation the committee believes the following conclusions are warranted: Punching holes or shearing edges in structural steel in accordance with the association's specifications slightly reduces the ultimate strength, very largely reduces the ductility at the hole and slightly increases the elastic limit. Of the 138 sheared and punched specimens which were broken, not one indicated an effect due to such manipulation until strains greater than the elastic limit were reached. The effects upon stretch, elastic limit and ultimate strength do not seem to be greater with granular fracture than any other. The effects of punching and shearing on the character of the fracture are somewhat more marked as the thickness increases, the exact limit of thickness where reaming is necessary being undetermined by these tests. The effects of shearing and punching seem to be wholly removed by planing and reaming concentrically, and there appears to be full as much necessity for planing sheared edges as for reaming punched holes. The difference in elongation between finished and rough holes seems large, but as failure in a riveted member would probably occur at one point with no stretch except at the weakest point, the committee believes that the ductility of the member as a whole would not be seriously affected.

It will be seen from this summary of the conclusions drawn from its experiments by the committee, that it has no novel ideas to advance. Confirmation of current opinion by extensive experiment is as satisfactory, however, as the establishing of the truth of a different and novel opinion, and the work of the committee deserves full recognition on that account. Incidentally the committee has officially recognized that shop procedure cannot be restricted too closely and has recommended changing the Association's standard specifications for punching so as to allow a 1/16-in. clearance for ¼-in. metal and ¼ in. for 1-in. metal, if punching is allowed in so thick material; if the thickness for punched work is limited to ⅝-in., the maximum clearance would be 5/32-in., which is just about right for smooth punching.

Non-Inflammable Wood.

So much has been written for and against non-inflammable wood that some recent tests of this material, conducted by Prof. Charles L. Norton, under the general direction of Mr. Edward Atkinson, are decidedly opportune. The attempt to make wood fire-resisting is an old one. Mr. Atkinson states that more than twenty years ago he investigated, and rejected absolutely, wood treated with ammonia salts under pressure. More recently it was introduced into warships of the United States Navy, but has since been taken out. Its quality is evident from the fact that one of the agents of mutual insurance companies saw tar kettles being heated by burning under them some of the so-called fireproof wood taken from such a vessel. Some of the slabs collected for experiments made in 1902 happened to be placed lengthwise against a wall in a rather damp basement and after a few weeks there one of them was found to be attacked by mould or fungus. As a result of the investigation made at that time the material was not accepted as in any sense fire-resisting, particularly after Mr. Atkinson made a fire in his fireplace with some of the samples submitted.

Since that time the makers have dropped the claim that the material is fireproof and simply assert that it is flame-resisting. They also assert that great improvements have been made in its quality, and that it deserves the position given it in the building regulations of New York City. On the other hand, owners of office buildings and contractors for such structures are opposing its required use in high buildings. It was accordingly decided to make new tests at the Insurance Engineering Experiment Station. These were of several kinds. In one of them, pieces of wood 6 in. long and ¾ in. square were placed in a horizontal electric muffle with inside dimensions of 3 x 3 x 8 in. and kept at a fairly uniform temperature of 1800° Fahrenheit. The wood was examined after exposures of this sort of one, two and five minutes. This test showed that none of the specimens were flameless, but the tendency of the untreated wood to flame on being heated is greater and the tendency of the flame to persist is stronger than is the case with the treated wood. The same results were obtained by placing specimens on a metal plate hot enough to ignite them thoroughly.

The test often used in New York is strongly criticised by Prof. Norton. This is made by holding a piece of wood, about 1 in. square and 12 to 18 in. long, in the flame of a Bunsen burner and noting the time taken to burn the stick across or the amount of wood unaffected after a certain period of time. Prof. Norton states that he has observed untreated specimens show equal or better results than treated specimens in this test, and he is not sure that wood making a poor showing in this test is not sometimes better than the average. The most conclusive test, in his opinion, is made by piling about forty pieces, each 6 in. long and about ¾ in. square, in layers at right angles on a grate or piece of wire netting. This cob-house construction makes a pile about 6 in. high with numerous chinks, and if it is placed over a Bunsen burner it is possible to study the ease of ignition, the persistence of the flame, its spread from point to point and the time required to destroy the whole pile, as well as to note the intensity of the fire. This test showed that the material made to-day is better than that of three years ago. At the latter date there was no difficulty in setting fire to the sticks, and material saved from those experiments and tested recently showed the same results; on the other hand, some of the new treated samples had to be reduced to ⅜ in. square before they would ignite. In a general way, these tests showed that the treated wood was unquestionably more difficult to ignite and burned less freely than the untreated wood. Other tests were made, but as their indications were the same it is unnecessary to refer to them.

The experiments as a whole show that many sources of ignition which will set fire to untreated wood in a few seconds must last at least five minutes to set fire to treated wood of the quality of some of the samples. Moreover, the flame and heat given off by the burning treated wood are much less than those from untreated material and there is very little chance of the fire spreading from the heat of its own burning. When the treated wood is kept in a dry place it apparently suffers no deterioration. On the other hand, Prof. Norton found that the quality of the material varied greatly, and he is unable to suggest any satisfactory method of determining the quality except by tests of many samples, taking so much time as to be impracticable from a business standpoint. Another feature of the subject which must be considered is that the wood is always varnished and this varnish is the most dangerous feature of the inside trim of the class of buildings in which treated woods are required. Although the recent tests indicate that there has been an unquestionable advance in the art of making wood flame-proof it is difficult to find any serious difference with Mr. Atkinson's judgment that there is no possible ground for making the use of such prepared wood compulsory.

Notes and Comments.

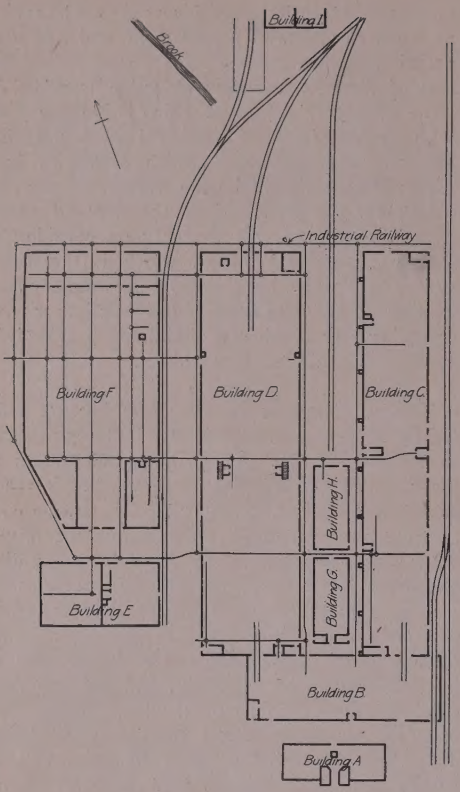
The Gas Turbine is discussed with considerable favor by Prof. S. A. Reeve in the "Engineering Magazine." In his opinion the possibility of developing good thermodynamic efficiency in the gas turbine by nozzle or guide-blade expansion in either one or several stages, is entirely parallel with that of the piston engine operating on the same thermodynamic cycle. The constructive difficulties lie in the necessity of expansive working from very high initial temperatures, with practically simultaneous development of power, and of compressing supplies to a high pressure in compressors operated by the turbine. The author advocates the admixture of a small quantity of water with the hot gases.

The Settlement of an Earth Dam, at Kettering, Eng., is described in a paper by City Engineer T. R. Smith. It is 12 ft. wide on top and has an inner slope of 1 in 3 and an outer slope of 1 in 2¼ for the upper half and 1 in 2¾ for the lower half. The maximum height is 46 ft. and the embankment has a puddle core carried down into a bed of clay 3 to 5 ft. thick. When the structure had been carried to within 7 ft. of its finished height, a settlement of the puddle core was observed, which gradually spread until it amounted to 7½ ft. Meanwhile, the inner face of the embankment began to bulge and this motion finally amounted nearly to 2 ft. The movement has been checked by driving a line of piles parallel to the foot of the inner slope for 200 ft. and about 20 ft. from it. A heavy toe, 15 ft. thick, has been formed over the ground extending from a line 25 ft. beyond the piles, and on this a new inner slope has been built against the embankment. Somewhat similar treatment has been given to a portion of the outer slope.

Architectural Licensing along the lines advocated by a committee of the Royal Institute of British Architects, appointed to draft a bill for presentation to parliament, has already aroused the keen opposition of important critics. The Institute itself is divided concerning the merits of the proposition, for many of the older and more influential members believe that architecture is so much an art that its practitioners should be ranked as much as artists as constructors, and that their artistic capacities cannot be expressed by any system of licenses. Another objection is raised by "The Surveyor," a journal which is in close touch with the Association of Municipal and County Engineers, an organization which seems to have been rather neglected by the framers of the proposed bill. In Great Britain the city and county engineers are required to carry on considerable strictly architectural work, which is threatened by the bill, while no provision is made for preventing a real estate agent or land auctioneer from designing any number of buildings provided he does not call himself an architect.

Hollow Concrete Blocks have become sufficiently important as a distinctive building material in Newark, N. J., to have a special section in the rules of the Building Department. It reads as follows: "Cement building blocks shall be constructed of a standard Portland cement mixed with sharp grit sand, free from loam or dirt, crushed stone, slag or gravel in proportions of 1 to 4; 1 part cement, 1½ parts of sand to 2½ parts of crushed stone, to pass through a ¾-in. mesh screen. Blocks shall not be larger than 36 in. long and 10 in. in height, and not less than 8 in. nor greater than 16 in. wide. Blocks may have one or more hollow spaces, provided not more than one-third of each block is hollow. Blocks shall be at least 30 days old before being used in any building wall, and shall stand a tensile test of 150 lb. to the square inch and 1,500 lb. compression test." As one of the first attempts to formulate regulations of this nature, this section is of considerable interest in spite of its poor wording and lack of precision. A discussion of the requirements in the light of experience in different parts of the country with blocks of different classes would be timely and probably put on record a set of more satisfactory model regulations. These blocks are becoming so common in building construction that it would be well to provide for them now in building codes rather than wait until poor blocks have brought the industry into disfavor.

Heavy Electric Traction is advanced another stage by the recent award by the New York, New Haven & Hartford R. R. Co. to the Westinghouse Electric & Manufacturing Co. of an order for twenty-five 78-ton, single-phase locomotives capable of hauling 200-ton local trains at an average speed of 26 miles an hour, with stops at intervals of 2.2 miles, and express trains of 250 tons at a rate of 70 miles. This equipment is for the trains on the portion of the road near New York, where expensive reconstruction has already been started along the lines indicated in this journal on October 1 of last year. The construction of the company's six-track passenger and freight entrance into the city has been overshadowed by the great changes being made at the Grand Central Station, but it is generally believed that the work is destined to have a marked effect on some of the transportation problems of the city. Incidentally the recent contract is of interest because of the long experience of the New Haven Company with electric operation. Although the Nantasket experiment begun ten years ago was unsuccessful in some respects, it has furnished many valuable data, and the company's other branches operated electrically have given it enough experience with this system of traction to make it certain that the contract just placed for heavy electric locomotives has been awarded in the light of as complete knowledge, theoretical and practical, as is available anywhere to-day. It is understood that the locomotives can be run over the New York Central tracks used by the New Haven system to enter the Grand Central Station.



The New Shops of the B. F. Sturtevant Company.

By Howard S. Knowlton.

The new shops of the B. F. Sturtevant Co. at Hyde Park, Mass., illustrate in a marked degree the influence of the engineer in securing economy of production. The plant is devoted to the manufacture of blowers, heating apparatus, engines, generators, motors, economizers, and forges; the aggregate floor area exceeds 9 acres and the location of the buildings upon a 20-acre lot provides for liberal future expansion. In moving the establishment from the old site at Jamaica Plain, Mass., the principal factors considered in deciding upon a new location were proximity to raw materials, the supply of skilled labor, ample water supply, convenience of shipping facilities and space for the disposal of waste material. The Hyde Park plant satisfies these requirements through its frontage of 1,300 ft. upon the New York, New Haven & Hartford yards at Readville, its location in an industrial center already well known as the home of other factories, and its ownership of unfilled land bordering upon an adjoining stream.

The works comprise a four-story 45x125-ft. office building, "A"; a three-story 80x250-ft. building, "B," devoted to engine and electrical testing, storage and electrical construction; a three-story 80x500-ft. building, "C," used for the manufacture of blowers, heaters, galvanized-iron work, etc.; a three-story, 120x500-ft. general machine shop, "D," with 40-ft. galleries on the sides, devoted principally to the manufacture of engines and economizers; a two and four-story, 80x150-ft. pattern shop, "E"; a foundry, "F," measuring 170x350 ft.; a two-story, 40x100-ft. locker building, "G," and a one-story forge shop, "H," measuring 40x100 ft. About 280 ft. from the shops on the north end is a two-story power house, "I," 80 ft. square, with a detached fire and service pump house. A 20x30-ft. oil house stands adjacent to the fan and heater shop, "C," at its north end. About 1,300 hands are now employed at the works.

Throughout the entire plant the transportation of raw material and products has been well worked out. Spur tracks from the New Haven yard are run into the lumber yard adjoining the pattern shop, the coal, coke and pig iron bins at the foundry, the power house coal pocket, the machine shop, the general stock yard between buildings "C" and "D," and past the shipping platforms of buildings "B" and "C". An industrial railway equipped with 12-lb. T-rails laid to 24-in. gauge crosses the various buildings as shown in single lines, with longitudinal spurs in the different departments. Cranes, hoists and elevators are also employed in large numbers, and over two dozen different styles of special hand trucks have been developed by the company to facilitate the internal movement of material and equipment. These trucks vary in size from a small two-wheeled affair resembling a heavy lawn mower and used in handling sheet iron, to large racks equipped with wheels, employed in moving heater tubes. The sheet-iron trucks will each carry a sheet 120x64x¼ in., and one man can handle about 320 lb. with ease. A special hand gripping tool enables a workman to pick up the heavy sheets unaided. Pipe trucks holding from 2 to 3 tons and angle-iron trucks that enable two men to handle 500 lb. in 6x6-in. irons are in regular use, saving the work of the two extra men that were required under the old methods. Other trucks are equipped with vises, to facilitate bringing the work to the tool, and additional designs are adapted to the handling of blowers, armatures, packing cases, etc.

The building construction is of composite character. Brick was used for all the walls; steel girders and columns were employed in all buildings equipped with traveling cranes; all upper floors are of plank with a top course of maple laid on heavy wooden beams, and in the case of the principal buildings designed for carrying loads of 200 to 250 lb. per square foot. In the machine, fan and erecting shops the main floors are of tar concrete, upon which 3-in. hemlock is bedded in liquid pitch and toe-nailed. The upper floors are carried upon hard pine beams on 4-ft. centers spanning the spaces between the steel girders, which follow a unit system of 20 ft. on centers throughout the buildings. The machine shop gallery floors were designed for 250 lb. per square foot, and are of 2½-in. plank, the other upper floors being of 2-in. plank. The roofs are all of 3-in. plank with tar and gravel top. The foundry roof is supported by steel trusses; in the other buildings open timbering is employed. Ribbed glass is used throughout the plant in all but the lower sashes, although in a few cases wired glass was adopted on account of the decreased fire risk. The accompanying transverse section through the machine shop illustrates the construction employed for the support of the heavier machinery, including the concrete foundations for the steel columns. The longitudinal section of the south end of this building shows the saw-tooth lighting employed in the roof, the gallery floors, elevator shaft and bridge between the east and west galleries. The skylights all face to the north, the lighting of the machine bays in the galleries being unusually clear.

All the machinery is electrically driven, and the plant is also heated and lighted from the power house, which is at present equipped with one 100-kw. set and one 250-kw. set, both direct-connected generators and vertical cross-compound engines built by the Sturtevant Company. The company furnished the mechanical draft and economizer outfits; the 1,000 h.p. of Stirling boilers are equipped with Jones underfeed automatic stokers, and the engine room contains in addition to the electrical machinery, a 1,000-h.p. W. H. Blake Steam Pump Co.'s surface condenser, and a 525-cu.-ft. per min. Laidlaw-Dunn-Gordon air compressor, which supplies air at 100 lb. throughout all the buildings. A complete underground tunnel system is provided for the distribution of steam, compressed air and electricity, the return of the water of condensation, etc., to the power house from the various buildings. The tunnel is of concrete 5 ft. wide and 6½ ft. high; it is lighted by incandescent lamps and is readily accessible through manholes and from the power house end. In the pattern building and foundry the pipes are laid in concrete trenches covered by iron plates.

In the main the fire protection in the works conforms to the New England Factory Mutual requirements. Hose boxes painted red are used in place of hose houses. About 3,800 Grinnell sprinkler heads are installed and fire pails are in evidence at convenient points. The plant is connected with the Hyde Park mains, which supply water at 90 lb. pressure. A Blake auxiliary fire pump of 1,000 gal. per minute capacity, Underwriters' type, is located in the pump house beyond the power plant. All openings between the buildings are fitted with Victor automatic shutters and at night a watchman service is operated.

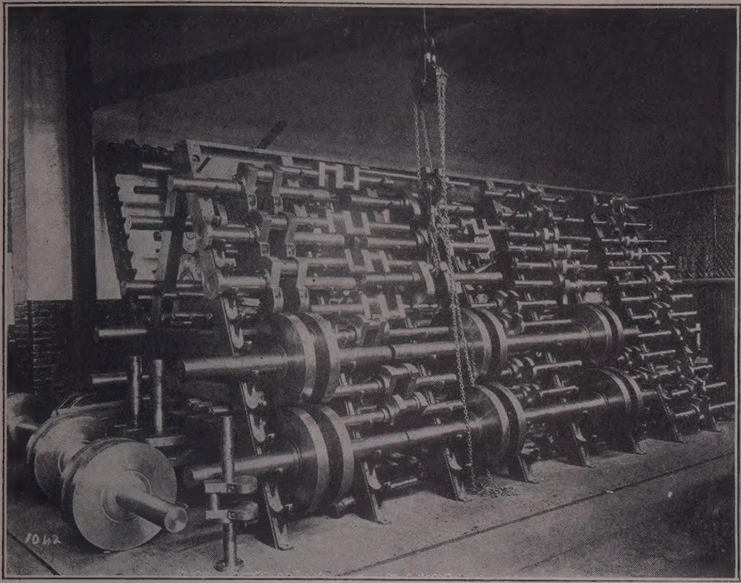
Heating.—Naturally all the buildings are heated and ventilated by the Sturtevant system. Exhaust steam from the engine testing plant, from the fan engines, and a supplementary supply from the power house are used in the heater coils. In the foundry the air distribution is made through a system of overhead ducts, discharging downward to the floor and thereby distributing the air in even volume and economizing in the amount of heat required. The heating apparatus is employed during the summer season to force cool air into the building. In the machine shop the hot air ducts are hidden beneath the wall benches of the second floor, whence they deliver the bulk of the air downward through the ceiling to the first floor. The heating coils of the machine shop are located one on each side of the first floor in the center of the building. Connected with each coil is a 7½-ft. up-blast fan direct driven by a 7x10½-in. engine, which draws the air in at the first floor level, passes it through the coils, 6,150 ft. of 1-in. pipe, and then discharges it into the duct system on the floor above. On the second floor the ducts are provided with vertical discharge pipes and hand dampers to supplement the downward ventilation. In the fan and erecting shops the air is supplied through an underground duct which delivers the hot air to external vertical brick flues on the west side of the building. In the fan shop these flues are located 40 ft. on centers and discharge across the building well above the height of the workmen. There are two heating coils aggregating 19,360 ft. of 1-in. pipe in the fan and heater shop, mounted side by side and supplied with air through two 10-ft. fans driven by two 9x12-in. horizontal side-crank engines. The underground duct connecting with these coils is of concrete.

The steam supply system is carried from the power house to a large manhole just outside the center door on the east side of the machine shop, in the underground tunnel previously mentioned. It consists of an 8-in. main carrying live steam at 160 lb., and a 14-in. pipe carrying 5 lb. for the heating system. A 6-in. return pipe is also installed in this runway. From the manholes the pipes branch in underground ducts to the heaters in the fan and heater shop, the machine shop, foundry, testing department, office and pattern shop. The fan engines take steam at 80 lb., the sizes of pipe dropping off as given in the table:

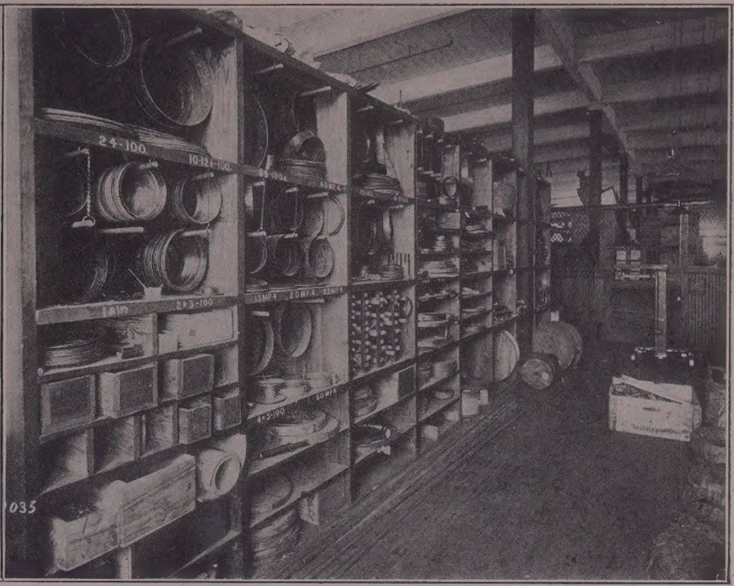
Pipe Sizes in Sturtevant Shops.

Location.	Main		Heating		Return
	Diam. in.	Press. lb.	Diam. in.	Press. lb.	Diam. in.
Manhole to machine shop...	5	80	9	5	4½
Across machine shop........	4½	80	8	5	3½
Machine shop to foundry....	3½	80	7	5	2½
Foundry to pattern shop....	2	80	3	5	1½
Manhole to fan shop........	5	80	9	5	4½
Manhole to test dept........	7	160	6	5	3
Test. dept. to office.........	2½	80	4	5	2

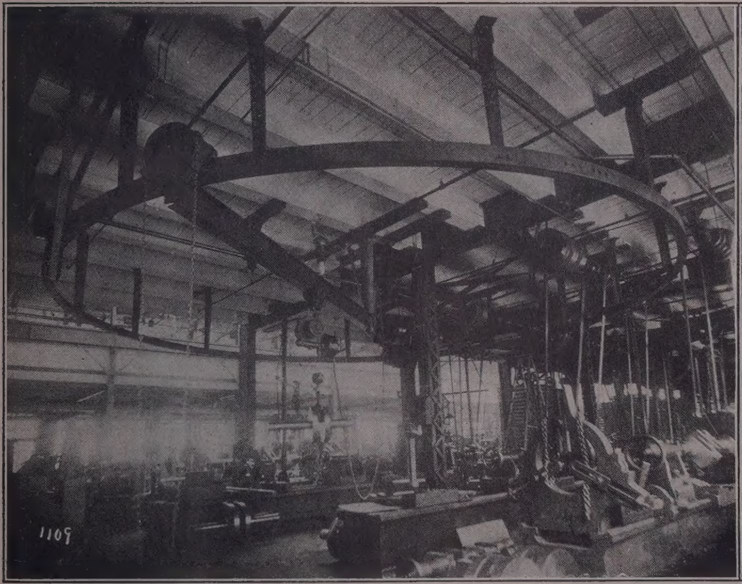
The testing department is supplied with warm air through two wall openings on the north side



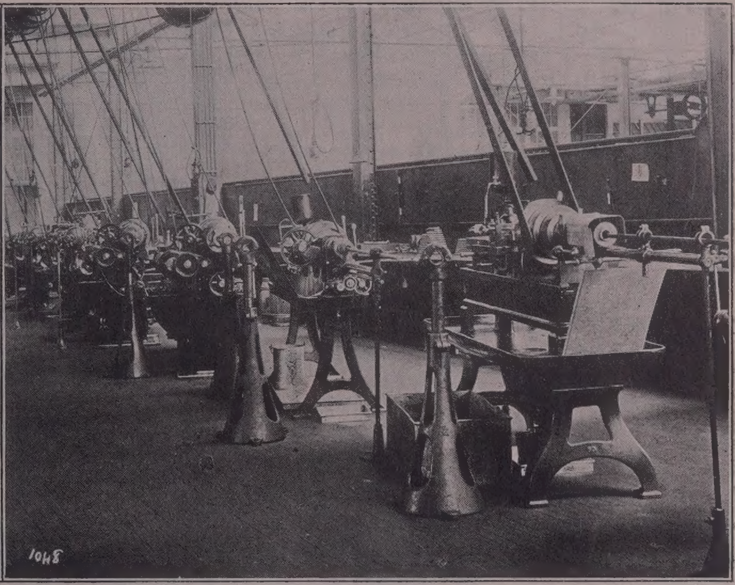
Method of Storing Crank Shafts.



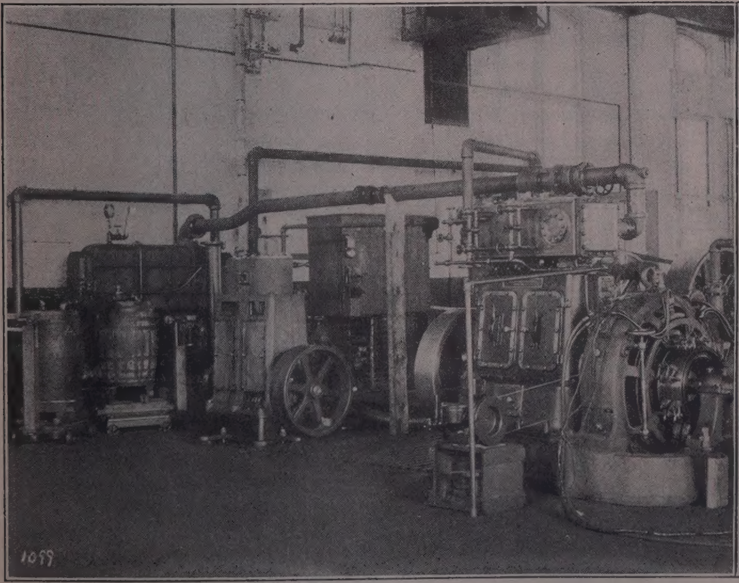
Method of Storing Electrical Supplies.



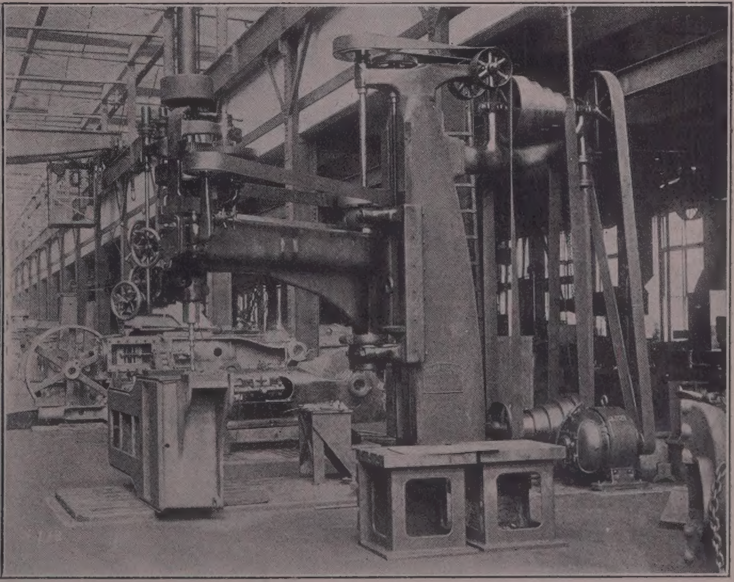
Radial Jib Crane in the Main Machine Shop.



Bolt and Thread Cutters, Machine Shop Gallery.



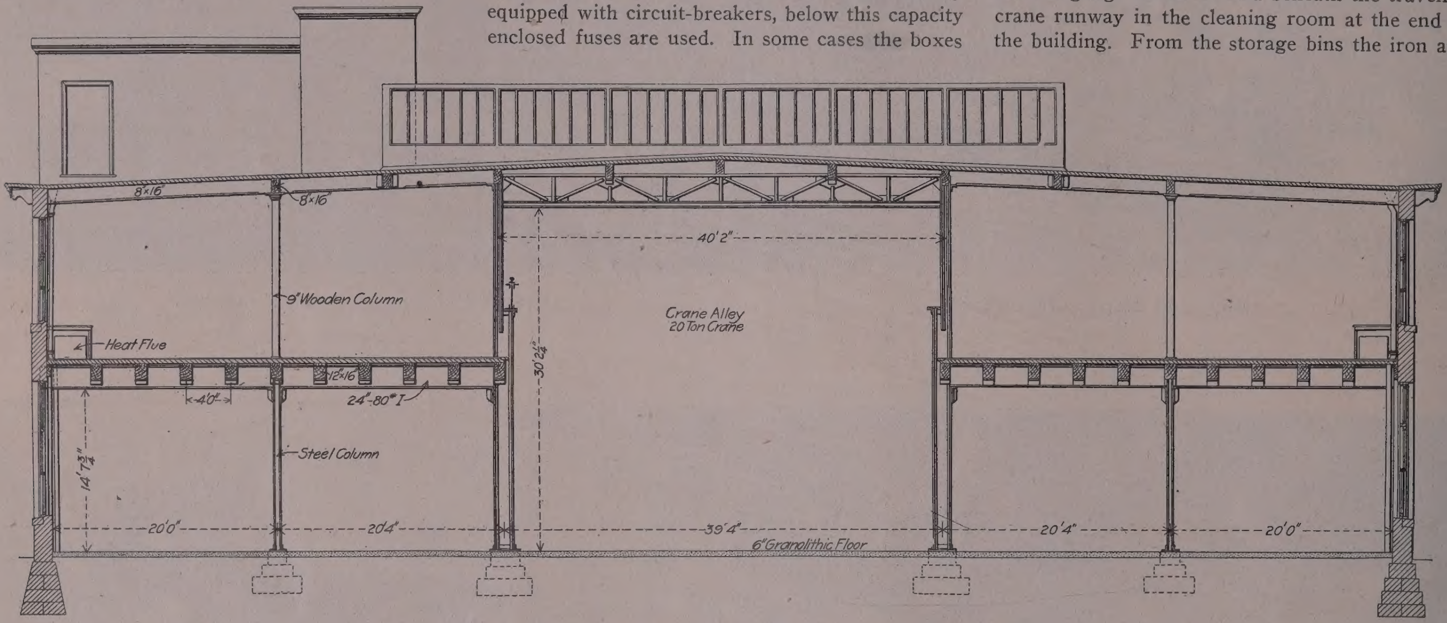
Direct-Connected Set in Testing Department.



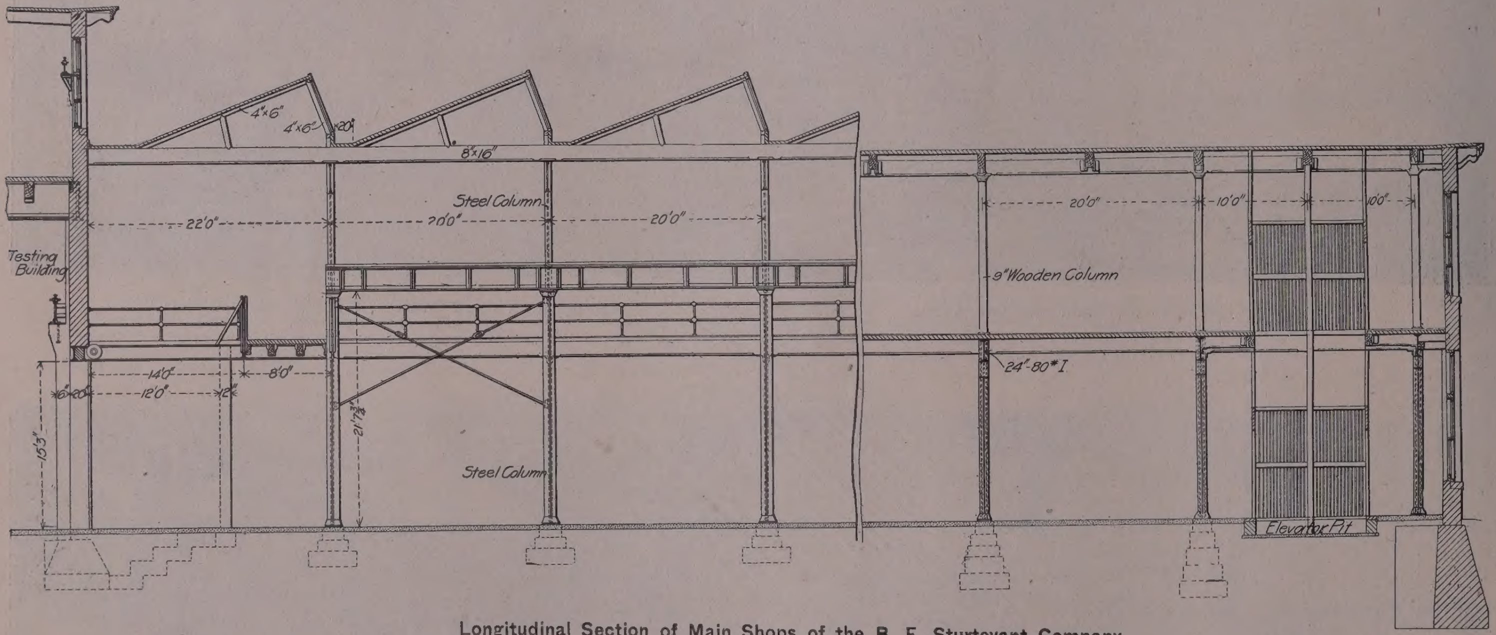
Motor Driven Radial Drill in Machine Shop.

connecting with the fan shop ducts, and it is also heated by the circulation of warm air which is always coming from the engine testing division. The 160-lb. pipe line supplies steam to engines under test and is used only indirectly for heating, through reducing valves.

Power and Lighting.—The entire electrical distribution for both power and light is carried out with direct current at 220 volts. The largest cables are 1,500,000 c.m. in cross section, and the system was figured for 2.5 per cent. maximum drop. Two-wire distribution was used throughout. Cables carried outside buildings are generally located in underground ducts, and they are supported on the walls of such conduits by split porcelain insulators. In the buildings the wiring is carried overhead. Distribution boxes are located on every floor, and in the testing department the columns are frequently provided with switch boxes, usually containing two jacks into either of which any one desiring power may plug a flexible cable. Special illumination is carried out by 16-c.p., 220-volt incandescent lamps hung from horizontal wooden brackets located about 10 ft. above the floor. These lamps are used in great numbers about the different machine bays and are supplemented for general illumination by General Electric, 110-volt, enclosed arcs operated two in series. An interior telephone system connects the different departments and the company has in its office building a private branch exchange of the New England Telephone & Telegraph, besides a telegraph office.



Cross Section of Shops D for the Engine and Economizer Departments.



Longitudinal Section of Main Shops of the B. F. Sturtevant Company.

Both group and individual driving is in use, but in the main the machines are driven in groups which can be handled by a 20-h.p. motor each. Only the larger machine tools are provided with direct-connected motors. All the large traveling cranes and the elevators are electrically operated. Starting boxes for motors above 10 h.p. are usually equipped with circuit-breakers, below this capacity enclosed fuses are used. In some cases the boxes are located on columns near the machine tools; in others they are mounted on the machine frames and mechanical connections are provided to permit regulation of the motor from the working points on the machine. All motors are of Sturtevant manufacture.

Pattern Building.—The pattern building provides at one end a two-story portion 80 ft. square for carpentry, flask making, metal work and pattern makers. The balance of the building is devoted to pattern storage and is provided with four intermediate floors bounded on the shop side by double fire walls and self-closing fire doors.

Foundry.—The foundry is designed for the distribution of molten iron upon a floor track system and it is equipped with a 24-in. gauge railway system bedded in concrete, forming runways between the moulding floors. There are two longitudinal craneways, each 35 ft. wide and a center bent of the same width, with side wings 35 ft. wide. The craneways are designed for 20-ton electric traveling cranes and the present installation is of Whiting make, with Sturtevant motors. The floor between the craneways is supplied with a series of 1½-ton small traveling cranes of about 10-ft. span, equipped with Sturtevant hoists. The narrow-gauge tracks extend beneath the traveling crane runway in the cleaning room at the end of the building. From the storage bins the iron and fuel charges, already weighed, are carried to the charging floor. The brass foundry is located in one corner, a wash and locker room in the adjacent corner, and the core room between the two.

Machine Shop.—From the foundry the castings pass to the rear of either the fan shop or the machine shop. The machine shop has a central crane-way 40 ft. wide, designed for a 20-ton crane. The present crane is of 10 tons capacity, with a 37-ft., 7¾-in. span, 23-ft. lift, main hoisting speed of 15 ft. per minute, bridge travel of 350 ft. per minute, and trolley travel of 120 ft. per minute. It is equipped with two 15-h.p. Sturtevant motors for the hoist and trolley travel, and a 2½-h.p.

motor for bridge travel. This crane serves the entire floor, and finally deposits the substantially completed engine or generator upon a transfer car, which passes through to the testing building on a standard-gauge track, where a 15-ton crane delivers the machine to the testing plate and eventually carries it to the shipping department at the east end.

In general large castings and forgings enter the machine shop at the northern end, and are transported by the crane, while smaller articles are brought in through numerous side entrances and are handled by hoists or by manual labor. The central narrow-gauge track is in the direct line of transit from the foundry to the forge and fan shops. On the ground floor in the corner nearest the erecting shop is located the 40x100-ft. general store room.

Tools are arranged for the progress of the work from the open end of the shop toward the testing department. At present economizers are manufactured near the machine shop entrance. In the open craneway are located two Detrick & Harvey open side planers, one a 60-in. machine with 18-ft. plane, belted to a 20-h.p. motor and the other a 16-ft. planer, 60x60-in. carriage capacity, driven by a 15-h.p. motor, belted; a 6-ft. Baush radial drill equipped with back gears and a 1½-h.p. motor to give 225 to 700 r.p.m., and an 8-ft. Baush plain radial drill belted to a 10-h.p. motor; a Beaman & Smith horizontal boring mill with 60-in. swing, geared to a 2-h.p. motor, and a 48-in. Johnson lathe, gear-driven by a 7-h.p. motor. Beneath the gallery is a line of planers, including a 60x48-in.x16-ft. Cincinnati machine with four heads geared to a 20-h.p. motor, also a group of horizontal drills and several boring mills. Beyond are milling machines, and on the other side of the shop various boring mills, including a 76-in. Bullard, driven by a 5-h.p. belted motor, several upright drills and a chucking lathe for economizer tubes, driven by a 3-h.p. geared motor. A 60-in. Niles boring mill with two heads is driven by a 7½-h.p. motor, and a Lands shaft grinder driven by a 15-h.p. motor.

Truck for Heater Tubes.

The second floor of the machine shop is entirely a gallery floor, and it contains the grinding and polishing room, brass finishing division, tool making and storage rooms and various small machine tools.

The machine shop is served by four elevators All are Morse machines, one having a capacity of 3 tons, and the others 2 tons. The former makes a speed of 50 ft. per minute, has a 12 ft. 8 in. x 9 ft. platform, and a lift of 32 ft., and serves the testing building, as well as the shop. It is chain driven by a 15-h.p. motor. The small elevators are each driven by a 10-h.p. motor, have a 17 ft. lift, speed, 50 ft. per minute, and 10 ft. 4 in. x 9 ft. platforms.

The compressed air supply is brought in a 6-in. pipe from the power house and carried through the shops in 3-in leads. Tools operated by pneumatic power are supplied through 1-in. pipes, and outlets are provided about every 20 ft. The air is used for blowing out cylinders, cleaning generators and motors, and operating drills, chisels, riveting hammers, snaggers, etc. On the first floor of the machine shop is a convenient jib crane with a 15-ft. radius, operated by compressed air and hand travel. It covers 710 sq. ft., and is of much help in handling crank shafts.

Fan Shop.—The fan shop is of typical mill construction, three stories in height. It is designed to facilitate the shipment of material, and a noteworthy feature of the first floor is a storage shed made up of diagonal alcoves capable of holding nearly 1,000 tons of plate iron. Half the fan shop is served by a 5-ton Whiting electric crane with two 7½-h.p. motors on the hoist and trolley traverse and a 2-h.p. motor on the bridge traverse. The span is 36 ft., 11⅛-in. speed, 15 ft. per minute on the main hoist, bridge travel, 250 ft. per minute, trolley travel, 120 ft. per minute, and lift, 23 ft. 4 in. The floor-to-floor height throughout this area is 32 ft. to provide room for the largest fans under construction. Motor-driven tools in this shop include a Niagara shear geared to a 10-h.p. motor, a 15-h.p. geared Bliss gate shear, and a set of 8-ft. Hilles & Jones bending rolls, geared to a 15-h.p. motor. Plates up to 120 in. in length and ½-in. thick can be handled here. The packing and shipping department occupies the center of the first floor, and the other end is devoted to the manufacture of heater sections for Sturtevant hot-blast apparatus. These sections are all given a hydraulic test of 180 lb. per square inch. On the second floor fan casings, forges, shafts, etc., are built, and on the third floor, exhaust heads, fan wheels from 6 in. to 20 ft. in diameter, distributing ducts, etc. The exhaust heads are stored by being hung from ceiling hooks, except in the larger sizes. The balance of the top floor is devoted to the punching and commutator work of the electrical department. The fan shop is served by two Salem elevators, each of a capacity of 3 tons, and a rise of 32 ft. The platform is 7 ft. 3 in. x 12 ft. 3 in., and the speed 50 ft. per minute. They are belt-driven by a 10-h.p. motor. There is also a Morse 5-ton elevator with a platform of 9 ft. 6 in. x 12 ft. 8 in., lift of 32 ft., and speed of 50 ft. per minute, driven by a 20-h.p. motor through a flexible coupling.

File for Shop Blue-Prints.

Adjoining the testing department on the third floor of building "C" is the baking room for armatures, 40 ft. square, entirely fireproof, and containing two steam heated ovens. An electrical store room is at the other end of the building. The balance of this floor and of the intermediate floor below is devoted to winding, assembling, testing, etc. Fans are here equipped with motors and tested under either Government or commercial requirements. Generators for direct connection are carried down to the first floor of this building, where they are set up with their respective engines and run on the test plate. The balance of the first floor is given to assembling, packing, storage and shipment. The testing plate, measuring 30 x 60 ft., is completely equipped with steam and electrical connections; engines may be run condensing or non-condensing and efficiency and performance tests of all sorts conducted. Numerous sets for the U. S. Navy have been tested here. An equipment for the testing of steam traps is also in use.

The crane in the testing department is a 15-ton Whiting, with a lift of 21 ft. 3 in., span of 36 ft. 7⅞ in., speeds of 10 ft. per minute for the main hoist, 275 ft. for the bridge travel, and 120 ft. trolley travel. Two 15-h.p. motors take care of the hoist and trolley travel, and a 2½-h.p. motor the bridge travel. The elevator at the south side, is a 2-ton Morse machine, with a platform 8 ft. 6 in. x 8 ft. 4 in., and a speed of 50 ft. per minute, chain-driven by a 10-h.p. motor.

Forge.—The forge shop is equipped with forges, power blower and exhausters for removing smoke, all of Sturtevant make. There are also a Dupont power hammer, an 1,100 lb Bement-Niles-Pond steam hammer, and shears for cutting angles and tees. High-grade iron and steel are stored under lock and key near the smith shop.

The office contains the correspondence, accounting, designing, drafting, production and advertising departments, a photographic and chemical laboratory, and in the basement, a lunch room and a motor-driven printing plant.

The general plans for the works were furnished by Lockwood, Greene & Co., mill architects and engineers, of Boston, and the steel work was supplied by the American Bridge Co. The entire industrial equipment, the blowers, motors, engines, economizer, heating apparatus, forges, exhaust heads, etc., were built by the B. F. Sturtevant Co., which took advantage of the occasion to illustrate the range and adaptability of its commercial products. No contracts were let for general construction, which was carried on by the company's own engineering force, by which the direct purchase of all building materials was made.

MOTORS FOR PAPER MACHINES, which require a great range of speed, have recently been specially designed by the Carlsruhe Electrical Industry Co. The system supplies power to each machine at a variable voltage obtained by means of a special motor-generator set. The voltage is controlled by varying the excitation of the motor-driven generator which supplies current to the machine motor. A further difficulty, however, arises on account of the fact that while the power of a motor is proportional to its speed, the power required to drive the paper-making machine does not decrease in proportion to the speed, the torque being much greater at the lower speeds. The motor which has been specially designed for these conditions is capable of developing 35 h.p. at 300 to 900 r.p.m. and 17½ h.p. at 150 to 300 r.p.m. at voltages ranging from 110 to 220, and with high efficiency over the entire range of speed. It is evident that the paper machines to be driven by the motor are very small in comparison with those used in the United States.

Recent Work on the Indiana Harbor R. R.

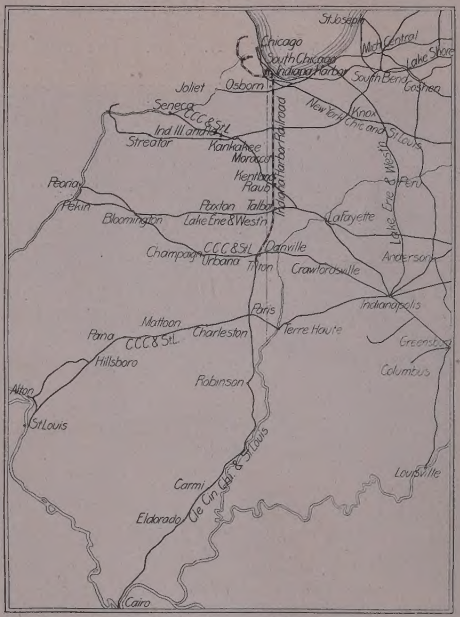
An extension is being built to the Indiana Harbor R. R., from a point about 6 miles south of Indiana Harbor, Ind., at the lower end of Lake Michigan, to Danville, Ill. The Indiana Harbor R. R. is a portion of the Vanderbilt system, and is at present a belt line operating in Chicago and vicinity on its own tracks and over those of two other terminal roads. The extension to it is to be primarily for freight traffic, and will provide a direct entrance into Chicago from Danville for the Cairo and the Peoria & Eastern divisions of the Cleveland, Cincinnati, Chicago & St. Louis R. R. These two divisions tap the extensive bituminous coal fields of Illinois and Indiana in their richest and most developed portions, but at present they are without any direct connection with the Chicago district, except over the tracks of other lines. The extension to the Indiana Harbor R. R. will afford such a connection for these divisions and will also intercept several other lines of the Vanderbilt system.

The extension is 108 miles long, and is to be a double track line throughout, with a maximum grade on the north-bound track of 12.5 ft. to the mile and a maximum grade on the south-bound track of 18 ft. to the mile. The maximum degree of curvature is 1 deg., and the total curvature in the entire 108 miles is about 220 deg., of which nearly 106 deg. are required in the last 4½ miles going into Danville. In order to build such a straight line and to obtain the low established grades it will be necessary to move more than 4,500,000 cu. yd. of material, or an average of 40,000 cu. yd. per mile, and to build approximately 40,000 cu. yd. of concrete in waterways, and in the abutments of overhead railroad and highway crossings.

The standard cross section of track in both cut and fill is shown in an accompanying illustration. Both tracks are to be laid with 80-lb. rails. The northbound track is expected to carry considerably more traffic than the southbound one and is to be laid with cedar ties and tie plates. The southbound track will be laid with oak ties without tie plates. Spring rail switches will be used exclusively on the main line tracks, and interlocking plants will be maintained at all railroad crossings.

The location surveys for the line were completed late in the spring of this year and contracts for its construction were awarded April 15, with the stipulation that the grading be completed and one track ready for operation by Nov. 15. The exceptionally wet summer which has occurred along the line has materially interfered with the prosecution of the work, but the first track will doubtless be in service by the specified time. The contractors have installed an unusually large amount of machinery, and in several instances grading is being carried on night and day. The machinery and forces now at work embrace 18 steam shovels, 25 grading machines, upwards of 650 teams handling dump wagons and slip and wheel scrapers, with a correspondingly large force of men and auxiliary contractor's plant. In order to avoid delay in the track laying, tracks are laid, or are being laid, at the intersections with other railroads for several hundred feet on either side of the crossing and interlocking towers and permanent switches installed at these points. Material yards have been located at several of the railroad crossings and nearly enough material is already in these yards to lay the first track. Track laying is to be commenced immediately at a point near the middle of the line with a Roberts track laying machine and the grading work will probably be ready as rapidly as the track laying progresses.

The line crosses a low swampy piece of ground in the first 6 miles south of the point where it starts at Osborn and then passes to considerably higher ground which extends for about 15 miles to the beginning of lower land that ends in the great Kankakee River swamp. The north portion of the lowland immediately south of Osborn is crossed by the Little Calumet River, and is frequently covered with water during the spring and early summer. The country very gradually rises from the river toward the higher ground at the south, but in order to avoid exceeding the established grades in reaching the high ground, a fill which is one of the most extensive pieces of grading on the entire line, had to be undertaken. This fill is a little more than 3 miles long, and nearly 600,000 cu. yd. of material will be required to bring the tracks to grade across it. The line crosses the tracks of the Joliet division of the Michigan Central R. R. and those of the Elgin, Joliet & Eastern R. R. about 1½ miles from the south end of this fill on an overhead crossing made up of two 110-ft. through double-track plate-girder spans, with a center pier and end abutments of concrete. The tracks of the Pittsburg, Cincinnati, Chicago & St. Louis R. R. are crossed about 2,000 ft. south of this crossing on a 210 ft. pin-connected Pratt truss span on concrete abutments.



Indiana Harbor R. R. and Vanderbilt Lines.

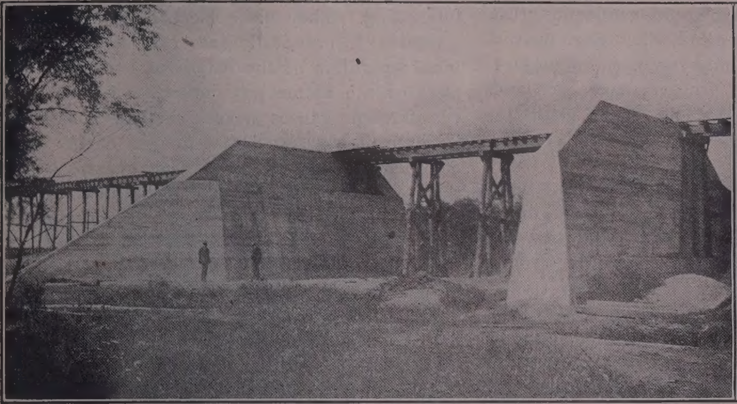
The construction of the concrete work for these crossings had to be carried on while the fill was being made and it materially affected the methods of executing the grading work. The fill as far south as the double railroad crossing was made with sand dug from a pit near Lake Michigan by steam shovels and hauled to the work in trains of standard-gauge cars. Each train usually contained 40 side-dump Rogers ballast cars, and the trains were operated over a track laid on the ground in advance of the work, the track being raised as the filled progressed. A temporary pile-bent trestle was built between the two railroad crossings, and as soon as the concrete work at the double crossing was completed the trestle was connected to the portion of the fill already finished at the north. The sand trains were then put in operation on the temporary trestle and the portion of the fill between the railroad crossings is now being made by dumping material from the trestle. The concrete abutments to the south could not be completed soon enough to permit the trestle to be extended over them and the remainder of the fill made in the same manner, so a steam shovel has been installed in a sand pit opened near the beginning of the high ground and about 1,000 ft. to one side of the line. Several trains of locomotives and standard-gauge side-dump Rogers ballast cars have been put in service in connection with this shovel to make the south end of the fill, which is being carried up from a track laid on the surface and raised as the fill is raised.

In the first two miles of the high ground beyond the big fill the work is not particularly heavy, the cuts and fills about balancing, but the line is ascending on a grade of 17 ft. to the mile, which is maintained for 3 miles. A steam shovel working in connection with standard-gauge trains is in operation at the north end of this portion of the work, teams and wheelers being used on the middle portion of the 3 miles. In the next mile, Mile 15, two heavy cuts are encountered, which contain about 160,000 cu. yd. of material that is being removed by a steam shovel. The cut to the south was hauled to Mile 16 in narrow-gauge cars by Porter locomotives and dumped from a pole trestle to make a fill. The cut to the north is now being taken out and is disposed of in a fill to the north. The country rises so rapidly in the next 4 miles that from 70,000 to 170,000 cu. yd. of material have to be moved per mile to bring the line to grade. Much of this work has already been completed with New Era grading machines drawn by traction engines and discharging in four-wheel bottom-dump contractors' wagons. A number of slip and wheel scrapers are also at work on the lighter parts of the grading.

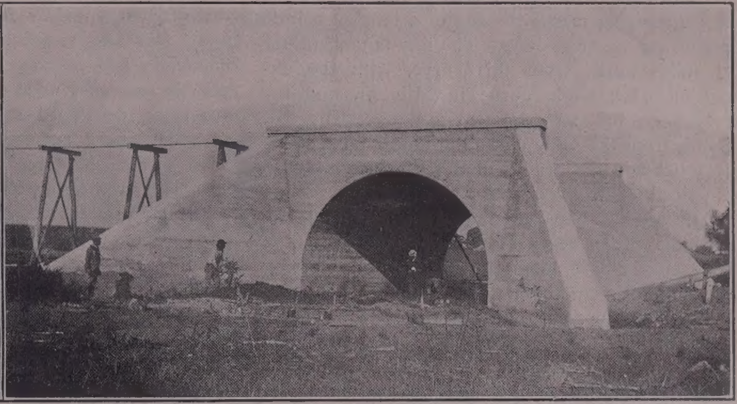
The summit of a long knoll is reached in Mile 20, and for the next two miles the grade is level with an ordinary amount of work, the summit extending about 1½ miles further before the ground begins to slowly drop away to the south. To gain this summit from the south required some of the heaviest work on the line, and for 6 miles the quantities run from 50,000 to 200,000 cu. yd. to the mile, the largest single piece of work being a cut a mile long, which contains about 180,000 cu. yd. of material. This cut is being made with a 2½-yd. 65-ton Bucyrus steam shovel, and the material hauled south in 3-yd. narrow-gauge cars by Porter engines to make fills from pole trestles in the next two miles. On Miles 27, 28 and 29 there is a large amount of heavy earth work which is mostly in short cuts and fills, and is being handled with two grading machine outfits. One outfit at the north end consists of a traction engine hitched to a New Era grading machine, 10 four-wheel bottom-dump contractor's wagons and several wheel scrapers. The other outfit embraces a traction engine, a grading machine, 25 four-wheel bottom-dump wagons and 20 wheel scrapers, the haul being greater than where the other outfit is at work. Sand is encountered in the cuts on this portion of the work and interferes with the operation of the grading machines to some extent, but this difficulty is more than offset by the ease with which wheel scrapers can be used in the sand.

A fill begins at the middle of Mile 29 and extends, with few interruptions, to Mile 47, the line being carried over the Kankakee River swamp and the adjoining lowland on an embankment which varies from 1 to 10 ft. in height. Much of this lowland is completely covered with water during part of the year and it is only recently since drainage ditches have been dug through it that any attempt has been made to cultivate a large part of it. These drainage ditches extend in both directions at frequent intervals across the country and vary from 4 to 50 ft. in width and from 2 to 20 ft. in depth. The ground water level in proximity to them is lowered perceptibly, but in places where no ditches have been built the water level has been close to the surface during the whole season and has made the grading quite difficult.

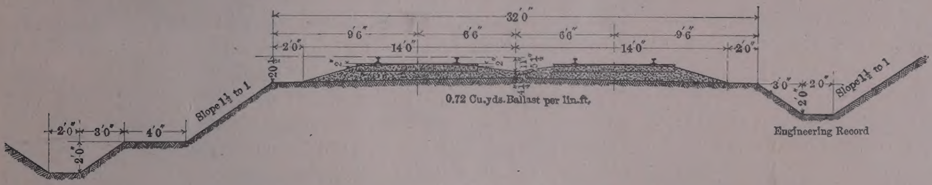
The first 2 miles of the long embankment is from 6 to 10 ft. high, and owing to the distance material from high ground would have to be hauled, the fill is being made from borrow pits on each side of the line. The ground is so saturated with water that any attempt to handle the material by ordinary methods was impracticable, and a specially devised scoop-bucket apparatus, which is shown in operation in one of the accompanying illustrations, has been built to carry on the work. The operating machinery is on a platform pivoted at the center on a timber framework which runs on wooden rollers laid on planks on the ground. A Lidgerwood hoisting engine in the cabin at the rear controls the movement of the platform, which rests on a pivot and a balancing gear wheel and is free to revolve. The scoop bucket is a rectangular sheet-steel box, open at one end, and suspended at both ends from the boom of a stiff-leg derrick mounted on the front of the platform. The excavator is set up just in advance of, and in line with the bank, and works crab fashion. The platform is revolved until the bucket is over the borrow-pit at the side when the bucket is lowered by the hoisting engine and filled by being drawn along the bottom of the pit by a cable on one of the hoisting engine spools. The filled bucket is raised in a horizontal position by the engine and the platform revolved until the bucket is over the bank when it is dumped by a special tripping gear on the engine. The scoop bucket has a 2-yd. capacity and handles satisfactorily material that is quite wet, as much as 1,000 cu. yd. being handled in a day. The bank for one track is being built first and when that is completed the excavator will start back and finish the other bank on the return trip.



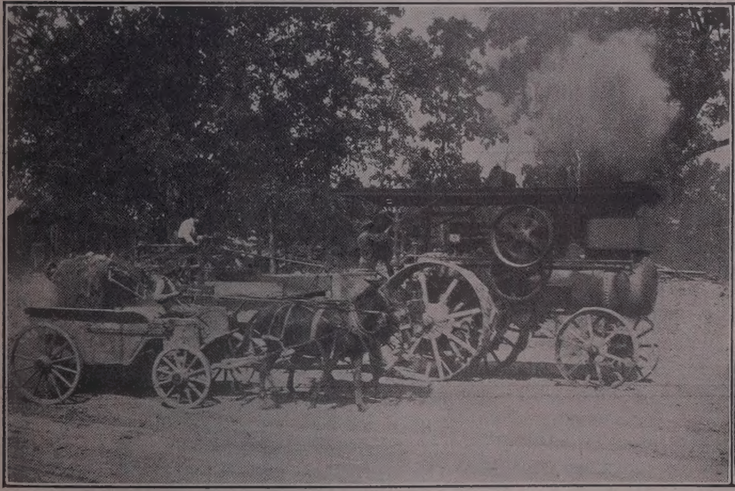
Concrete Abutments for a 60-ft. Plate-Girder Span.



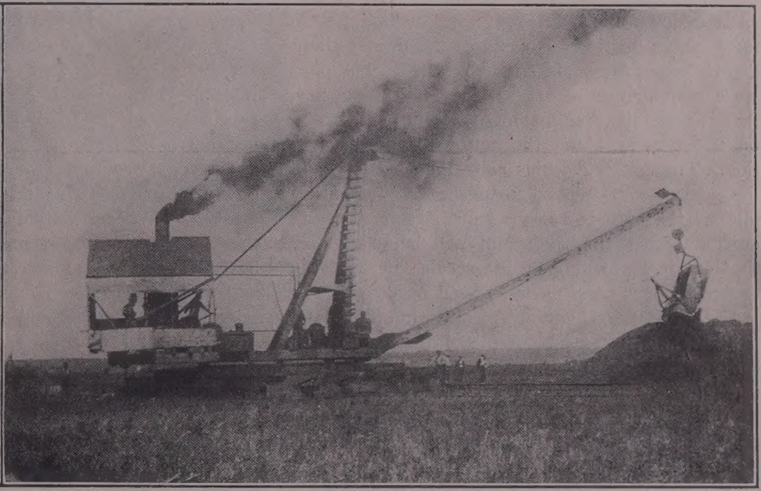
A Standard 20-ft. Concrete Arch.



Standard Cross Section of Track, Indiana Harbor R. R.



A Grading Machine Drawn by a Traction Engine.



Scoop Bucket Excavator in Operation.

At the end of this first portion of the long embankment is a cut 1,500 ft. long containing about 13,000 cu. yd. of material which is being used in making a portion of the fill adjacent to it. A fill a little more than 4 miles long begins at the end of this cut and crosses several large drainage ditches and the Kankakee River. The ground across this stretch is very low and flat, the water level being at the surface in many places. The embankment in the first 2 miles of this stretch is being made with a floating dipper dredge. A drainage ditch about 50 ft. wide crosses the line near the north end of the work and the dredge was started near this ditch. The excavation is made at one side of and parallel with the line, one bank being brought to grade at a time. A temporary dam was built across the drainage ditch, the borrow-pit connected with the ditch above the dam and an overflow provided which wastes into the ditch below the dam. The dredge will make a single cut the full length of the work, finishing one-half the bank, and then turn across the line in a drainage ditch and complete the other half of the bank on the return trip. The material excavated is a coarse sandy loam which makes a good bank when above the water line, and the borrow-pits will be connected permanently with the drainage ditches.

The Indiana, Illinois & Iowa R. R. is crossed at the end of the dredge work, and beyond this crossing is a small cut which was made by teams and wheel scrapers. The Kankakee River is crossed a mile south of this railroad crossing, and at the river crossing is encountered the lowest point on the line. The normal width of the Kankakee River is 160 ft., with an average depth of about 6 ft., but it is often more than half a mile wide where the line crosses it. The river proper will be crossed on two 80-ft. deck plate-girder spans, with a pile trestle at each end, the total length of the trestle being 1,700 ft. The piles in the trestle are being driven by a driver traveling on the finished work. The bottom is a hard sand which makes an excellent foundation, but has caused some difficulty in driving the piles.

The ground for the next 6 miles to the end of Mile 41 is slightly higher than that immediately on each of the Kankakee River, and the work is light, the grade of the tracks being practically flat. This grading work is largely low-fill and has nearly all been completed by teams and wheel scrapers with material from side borrow-pits. The bed of Beaver Lake, a low, swampy stretch of ground which is covered with water to a slight depth during part of the year, is crossed by the next 3 miles of the work, and considerable difficulty has been encountered in attempting to bring the embankment to grade with material from side borrow pits. The grading from the south side of this work to Morocco, a distance of 5 miles, is light, easy work and has been carried on with slip and wheel scrapers.

A large material distributing yard has been laid out at Morocco and sufficient material is on hand at this point to lay about 50 miles of track. An interlocking plant has been erected here at the crossing of the Chicago & Eastern Illinois R. R. and permanent switching connections made with this road to facilitate the delivery of additional material. A Roberts' track-laying machine is being put together in the temporary yards and track laying will be commenced at once.

A 30-min. curve about 400 ft. long at the end of the mile below the Chicago & Eastern Illinois R. R. crossing marks the end of a tangent a little more than 20 miles long. The line is tangent for 25 miles north from this curve, with the exception of a slight curve in Mile 31, and the grades on this long tangent are practically flat. South from the same curve the line is tangent for 17 miles and the grades in this distance are also practically flat.

The divide between the Kankakee and the Iroquois Rivers reaches a summit near the curve between the two long tangents and in crossing this summit a cut about 1½ miles long which contains 150,000 cu. yd. of material has to be made. This material is removed by a Marion steam shovel and is utilized in a fill which extends for 2 miles from the south end of the cut. The work between the end of this long fill and the crossing of the Iroquois River, in a distance of 3 miles, is light and has been carried on with team outfits. The only grading of any particular moment in this stretch is the changing of the channel of a creek for a distance of 1,700 ft.

The crossing of the Iroquois River is made on a 164-ft. pin-connected Pratt truss. The water level in this stream varies 20 ft. and a short, heavy fill, which has been made from side borrow-pits, was necessary to carry the line across the valley. The concrete abutments on which the river span is to rest are being built on pile foundations. The excavation for the abutments was carried down until the firm sand, which lies in most places on the north end of the line at slight depths below the surface, was reached. The piles were then driven to refusal in a stiff blue clay, that is generally found below the sand, and sawed off about 24 in. above the bottom of the excavation. The concrete forms were then built up and the concrete laying commenced. A temporary pile trestle, built to carry regular traffic, is being erected across the river and will be used after the line is thrown open for service in case the bridge for this crossing is delayed in arrival.

The grading in the next 2½ miles into Kentland is light and has been completed by teams with slip and wheel scrapers. The line rises steadily for 4 miles south from Kentland and in 2 miles of this length nearly 130,000 cu. yd. of excavation has to be made to avoid exceeding the maximum southbound grade. A summit is reached at the end of this 4 miles and the grade begins to descend at the south, a cut 4,000 ft. long, which involves 160,000 cu. yd. of material being required at this summit. This cut is being made with a 65-ton Vulcan steam shovel, and the material handled in two sixteen-car trains of 6-yd. standard-gauge dump cars drawn by standard-gauge locomotives. The material is used to make the greater part of a fill containing 180,000 cu. yd. in the next mile south. This fill is made from a pile trestle nearly 1½ miles long. The completed concrete abutments for a 60-ft. plate-girder span toward the south end of this fill and a portion of the pile trestle used in making the fill are shown in one of the accompanying illustrations.

(To be continued.)

The 5,000 H.P. Gas Engines of the California Gas & Electric Corporation.

A paper read for the Pacific Coast Gas Association by J. Martin.

The very rapid progress in the development of electrical machinery and appliances during the past ten years has invited the capitalist and engineer to install and operate many hundred thousand horse-power of apparatus, utilizing the waters of the various streams as a source for generating the current. The prime incentive for such development from the inventor's standpoint was the fact that the source of power was being constantly renewed by the laws of nature, and with the authentic records of precipitation as a guide the prudent engineer has recommended a great many plants to be constructed which have proved financially and commercially successful. The most notable examples of this progress have been and are being developed in the State of California. A great many surprises of a practical nature have been encountered by the managers of these various water power electric developments with particular reference to earning capacity, and more particularly with reference to the relations of plant utility to plant capacity, commonly termed "load factor." The manager is constantly trying to find ways and means of utilizing the electric current during such times of the day or night when his present consumers do not require it. Numerous plans and devices have been utilized to further this end.

Within the past year the problem was presented to the officers of the California Gas & Electric Corporation, who were desirous of furnishing all the electric current for the operation of the street railroads under the control of the United Railroads of San Francisco, and negotiations were commenced with the officers of the latter company with that end in view. It was very difficult for the railroad people at first to develop even a hope that such a condition of affairs could be made feasible. Here was a company with its thousands of horse power developed at no point nearer than 140 miles from the proposed place of consumption, and while it is true that this company has many sources of supply and many avenues of delivery, yet there was an insurmountable barrier in the minds of the railroad people as to the advisability of purchasing current at any price if the convenience of its patrons was to be sacrificed in any way. As one of the officers of the railroad company remarked: "We certainly desire to save money in the operation of our property, within reason, but at the same time we care more for the good-will and satisfaction of our patrons, and if any interruption of service should occur on all your lines feeding into the city at one time, we cannot expect our citizens to be patient while sitting in the cars for one and one-half hours until you get up steam."

The railroads are operating their steam plant for this service, and the power company suggested the continuance of the operation of these steam plants and receive a portion of the power from the power company, but this plan was not considered advisable. After numerous interviews, with an honest desire on both sides to try and accomplish the economic result, if it could be done without sacrificing the interests of the patrons of the railroad company, a firm conclusion was reached that in a service so large and important as the carrying of hundreds of thousands of people daily in a large city, nothing could be done on the plans outlined unless some absolute guarantee of continuity of service were available, and it certainly was not favorable from the standpoint of the utilization of steam engines for emergency purposes, because if steam were being maintained constantly under the boilers, no economy could result, and if the plants were allowed to cool off the time element of starting would prohibit their use.

The officers of the power company had been making thorough investigations of the development of the gas engine in large units, having sent two of their engineers throughout the entire East to make full and complete reports. In consequence, and as a last resort, the power company agreed to install three gas engine electric generating units, each unit having a capacity of 4,000 k.w., or a total initial capacity of 12,000 k.w. This plant will be enlarged as rapidly as the requirements of the railroad may demand.

The guarantees which have been made by the manufacturers of these engines are particularly interesting. They place electric transmission in a position to practically guarantee continuous service, regardless of the length of its transmission lines or the momentary interruptions which occur through causes beyond human control. It might be fairly stated that the gas engine stands alone as the only means of instantaneous generation of electric current at distributing centers in times of emergency at any fair or reasonable cost.

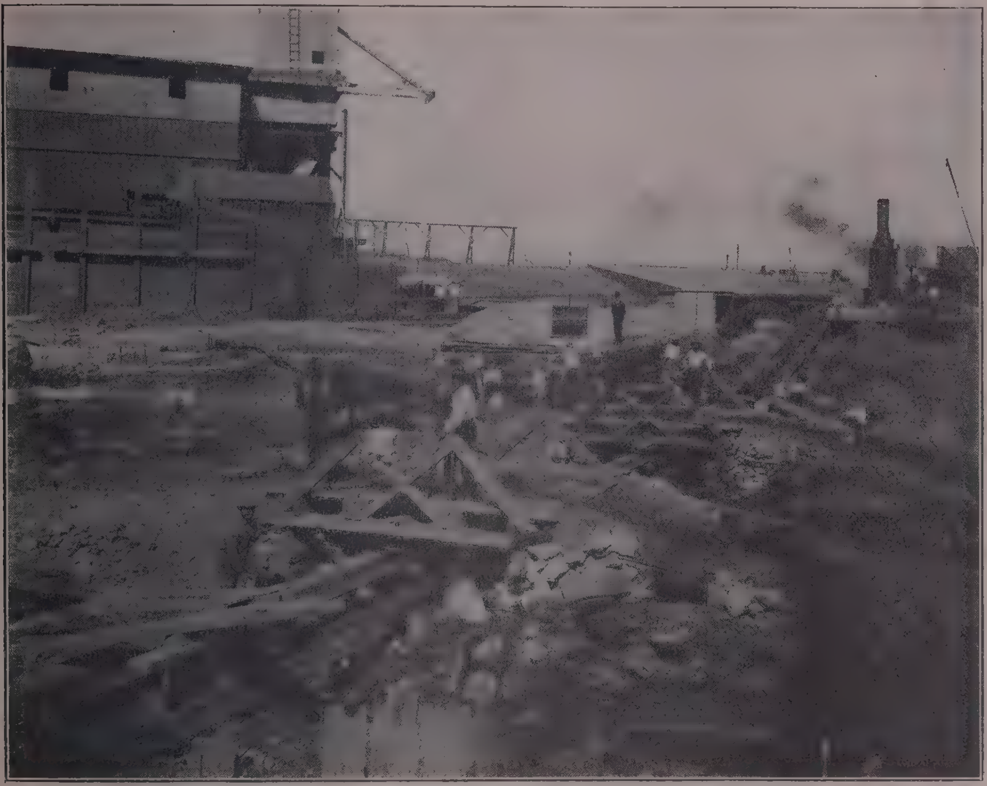
The gas engine electric generating plant of the California Gas & Electric Corporation will also be utilized to a certain extent for the purpose of increasing the load factor of the transmission line, for it is obvious to those familiar with power transmission plants that after proper installations have been made, including full capacity at the hydraulic end, as well as in the power house, and in pole lines, there is absolutely no increased cost for current to the power company, whether its load factor be 0.2 or 0.99, and any device which can be utilized to improve the load factor adds that much income and net profit for the power plant. In this particular case the gas engine generating plant was a necessity, for without it the California Gas & Electric Corporation would have been unable to have obtained the contract for power. That being the case, the officers decided to make a virtue out of this necessity, and up to the extent of the cost of fuel being less than the increased value derived from improving the load factor on the power lines, they propose to operate this gas engine plant in that manner and for that purpose.

The gas which will be used to drive these engines will be manufactured from crude oil and will be of the quality similar to the illuminating gas now being distributed throughout the State of California manufactured by this process, ranging from 610 to 660 B.t.u. per cubic foot.

Nearly all of the gas engines in use throughout the East and Europe are utilizing producer gas or blast furnace gases, except in very small units or where natural gas can be obtained, and from investigations which I have made I have ascertained that the largest engine using manufactured gas of more than 600 B.t.u. has a rated capacity of 300 h.p., while those in process of installation near San Francisco will in each case be more than seventeen times as large. The nearest approach to these large engines in size are two which are in operation at Hastings, W. Va., each having 4,500 h.p. capacity and driven by natural gas. They are used for the compression of natural gas for transmission through a pipe line 200 miles in length. These engines have been and can be started from cold and rest to full load in less than 60 seconds.

These gas engines are now being built by the Snow Steam Pump Works, of Buffalo, N. Y., and in general design and detail resemble very closely a modern high-grade massive American steam power engine. They are of the horizontal, twin tandem, double-acting four-cycle type, giving two impulses to each crank per revolution. This is equivalent to a cross compound steam engine. Any cylinder head can be removed from any cylinder by simply disconnecting one jacket-water supply pipe and removing the nuts holding the head to the cylinder. All working parts are above the engine room floor; nothing but water supply, gas, air inlet and exhaust pipes are below the floor, and these are arranged so that they can be trenched. All the main parts have their proper relative positions positively and permanently fixed by male and female centering fits of large diameter, thus practically insuring self-alignment.

Lubrication of the cylinders is effected by spreading. This is accomplished by leading four oil feeds, fed by individual oil pumps, to each cylinder, and entering the cylinder at points to effect successfully the proper spreading of the oil. The oil is fed to the cylinder on the inhalation stroke, and is spread on the compression stroke, thus being properly lubricated for the power or impulse stroke. The lubrication of journals is effected by means of a positive feed lubricator. Each oil feed is carried to the part to be lubricated by means of small tubing leading from a multiple feed oiler containing a small oil pump for each feed led therefrom. The feed to each part is positive and can be adjusted to give a fixed supply of oil per revolution of the engine. When the engine stops the oil feed stops, and when the engine starts the oil feed also starts. Inlet valves, mixers and cut-off valves will be designed so that gasoline can be injected to the surfaces to be cleaned, rendering the dislodgement of any deposit an easy matter without removing the parts.



Handling Material from Building Excavation with a Belt Conveyor.

The pistons are carried by cross heads, thereby materially reducing the weight carried on the bore of the cylinders. By the use of three cross heads, the main, intermediate and outboard, the proper alignment of the pistons is permissible after years of service and it is questionable whether an engine without this feature can be regarded as entirely satisfactory.

The question of regulation in the generation of electric current by means of direct-connected generators (of Crocker-Wheeler make in this case) has been a problem not only for the gas engine people but for the steam engine manufacturers to solve, and this has been done in the latter case within the past two years practically to the satisfaction of the electrical engineer, so that parallel operation is now successful. The builders of this engine are also following steam practice in this respect, and will be able to keep the angular variation within each revolution at a minimum, satisfactory to the generator manufacturers.

The main shaft will be of the overhung crank type, having the cranks forged with the shaft and with crank pins forced into the cranks. The main connecting rods are simple, plain, with solid adjustable stub ends. The main cross heads are fitted with adjustable babbitted gibs and removable crucible steel wrist pins.

The pistons are designed in such a way that expansion of the faces can take place without affecting in any way the strength or life of the piston. Piston rods extend from the main cross heads clear through the cylinders to the outboard cross heads, to which they are secured by nuts.

Each cylinder is made in two parts, the joint being circumferential and located half way between the ends.

Separate supply pipes for each individual part to be water jacketed will be furnished, so that the amount of water fed to each part can be regulated, thus permitting the carrying of high temperatures in such parts as cylinder heads, medium temperatures in cylinder jackets, low temperatures to the rods, pistons and metallic packing.

These engines are started by the use of compressed air on storage in compression tanks. Safety devices are provided which carefully control the speed limit.

The dimensions of these engines are very interesting: Length over all, 70 ft.; width over all, 34 ft.; weight of heaviest casting, 60 tons; diameters of cylinders, 42 in.; length of stroke, 60 in.; main journals, 30 in. in diameter, 54 in. long; main cross head gibs, 27 in. wide, 54 in. long; diameter of center of shaft, 38 in.; weight of flywheel, 130,000 lb.; total weight of engine, flywheel and generator, 1,200,000 lb.

These engines will probably be in operation on or before January, 1906, and from all the investigations which have been made by my co-workers, we are laboring under no doubt as to the absolute success of this installation when completed.

Handling Excavated Material by Conveyors.

The accompanying illustration shows a belt conveyor being used by F. M. Stillman & Co., for carrying off excavated material from the site of the new gas house of the Mutual Gas Light Co., at the foot of East 12th St., New York City. This conveyor was furnished by the Robins Conveying Belt Co., of New York. It is 30 in. in width and 172 ft. between centers of the end pulleys. As will be noted, bridges have been built over the conveyor. These have a 3x4-ft. space cut away in the center, directly over the conveyor, and these spaces are spanned by grizzley bars so as to prevent excessively large material, such as pieces of old timber, railroad ties, etc., from dropping on the conveyor. Wheel scrapers take the dirt from the ground on either side of the conveyor and dump on to it through the cuts in the bridge. The material is also shoveled on to the conveyor by men stationed along its run. A great deal of difficulty has been experienced in excavating in this place because of the large amount of clay bricks found on the ground, which form part of the foundation of a former structure. A third way of loading the conveyor is by means of a stiff leg derrick of the bull-wheel type which delivers a load of 1⅝ yd. to the conveyor at one time. The conveyor is driven by a Lambert engine situated at the discharge end.

Excavating has reached a point where the men are now working below tide level, consequently water has to be pumped out almost every day. This water in some parts completely covers the return belt of the conveyor, but in no way interferes with its work. The conveyor is gradually dropped down as the work proceeds. In doing this it is not necessary to lower the conveyor so as to maintain any regular grade as it can be operated out of line when considered vertically. It is evident from the above that if a cave-in occurs, the conveyor can be blocked up or lowered at the break without in any way interfering with the operation of the system.

It has long been known that there are few methods as economical in operation as wheel scrapers, where they have a short haul and horses can be worked continually. In the operation described above, the wheel scrapers receive a full load, and by crossing one bridge dump it and again obtain a full load and discharge it through the second bridge before returning to the starting point. This gives a cycle of operation and a team has to travel no great distance without a load. The material is discharged from the conveyor into scows tied up at the dock along the bank of the river.

Chemical Novelties of much promise for certain engineering purposes are now being produced electrochemically at Niagara Falls. They are peroxides of sodium, calcium, magnesium and other metals, the most interesting being "oxone," or sodium peroxide. It is made in tablets weighing 70 grams, and is used in generating oxygen. By placing a pound of these tablets in water, 2.08 cu. ft. of oxygen is given off. The decomposition of the peroxide gives sodium hydrate, which absorbs carbon dioxide. Consequently, these tablets are useful in confined working places for renewing the supply of oxygen. The calcium and magnesium peroxides have strong sterilizing properties, and a tablet containing 0.1 gram of magnesium peroxide and 0.5 gram of citric acid is said to be able to thoroughly sterilize a liter of water in a few minutes.

Power Capacity of a Running Stream Without Storage.

One of the most frequent complaints about power plants utilizing a river without storage is that they rarely give as much output as the designer estimates from the rainfall and runoff records. This experience has been discussed somewhat by Prof. D. W. Mead, and was elaborated in a paper by Prof. Wm. G. Raymond before the Iowa Engineering Society. Both authors point out the source of the trouble to be an incorrect method of using the data of stream flow, and Prof. Raymond's analysis of the conditions is so complete that it merits careful consideration.

In determining the percentages of flow on a given stream, it has been customary to average the flow for a number of years for each calendar month. If the calendar months are arranged in the order of their average yield, and the yields of these months are plotted to scale, a more or less irregular curve is the result, usually showing periods of regularity of from three to five months, broken by considerable differences of flow between these more regular periods. If, now, it is proposed to develop a stream for which such a plot has been made, and it is desired to determine for a given power development during what portion of the year there will be sufficient water for the operation of the complete plant, and also the aggregate shortage for the year which must be made up by steam if a plant is to run continuously, the quantity of water necessary to supply the required power with the given head is determined and marked on the diagram. All those months which fall below the line of required yield will be short of power, while those months above will furnish full power, unless there be loss of head during extreme high water.

If the records of flow are carefully examined, it will be found that there is no year of any considerable period of years in which there is not one or more months yielding considerably less water than the lowest average calendar month; thus, if by averaging the calendar months for a period of years it is shown that July yields the smallest amount of water, it will be found to be true that in each year there will be one or more months which will yield less than the average for July.

If there is no storage on the stream to equalize its flow, the more rational way of arranging the monthly records for power development, Prof. Raymond says, is to average the lowest of the months of all the years, the next lowest, and so on; that is, the months of each year should be arranged in their order of flow, and the average of all the lowest months, next lowest, etc., taken. The average of the months in their order of flow will show for the months of low flow a much less yield than the average by calendar months, and as the total flow must be the same, the averages of the high months are materially greater than the averages of the high calendar months.

Some time since Prof. Raymond had to determine what portion of time a plant requiring about 170 cu. ft. per second for its full power development would be without full power. This plant was located on a stream not unlike Perkiomen Creek, near Philadelphia, and of approximately the same drainage area. This draft is equivalent to 1¼ in. on the drainage area of the Perkiomen. Drawing the horizontal line representing 1¼ in. on a diagram showing the run-off of this creek by calendar months and "order-of-flow" months, it was seen that by the average of calendar months there would be some shortage of power during five months of the year, and if the shortages for the several months were summed it would be found that the total shortage was equivalent to full power for about three-quarters of a month. The line showing the average of months in order of flow indicated that there would be a shortage for the same period, but that the aggregate shortage was nearly three times that shown by the average of calendar months.

From these and other considerations, Prof. Raymond holds that the far more reliable method of arranging run-off records for determination of power when there is to be no large storage on a stream, is to arrange the monthly records in the order of flow rather than by calendar months. But even this is very far from the most desirable method. Particularly in the low months is the record of a whole month affected by the run-off of one or two days during or immediately following heavy storms. So that the monthly record never shows less than the power available in the stream, and practically always shows more power than can be used, since during the two or three days which bring up the total flow of a month the discharge is far in excess of that that can be used, and the greater portion of the water goes to waste.

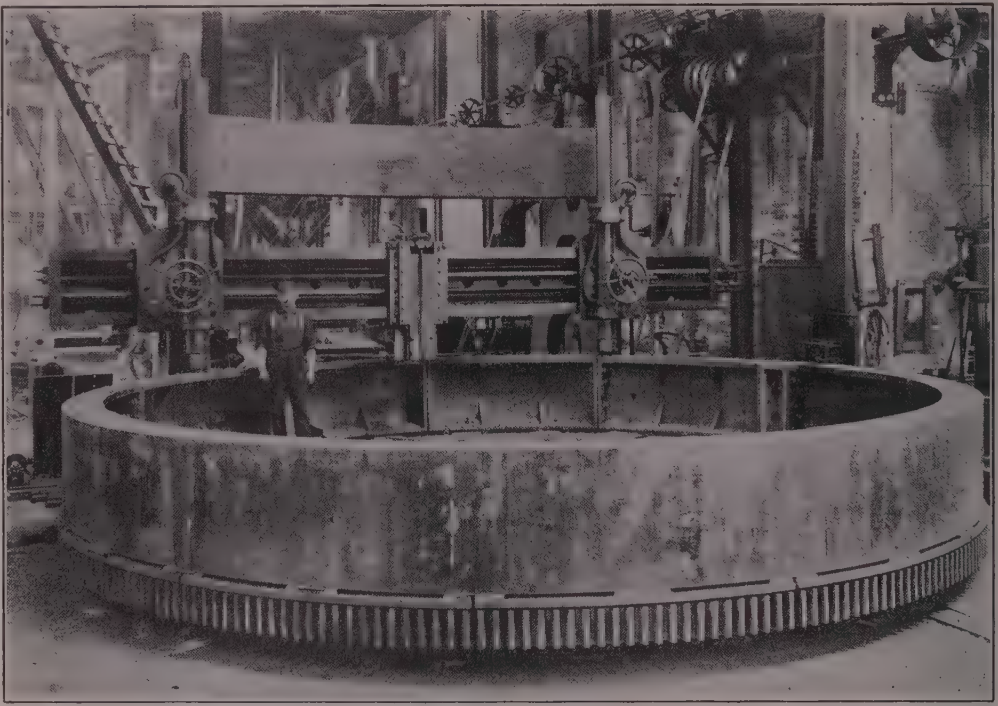
Daily records of the Perkiomen Creek for 1887 to 1891, inclusive, and 1893 furnish information for a comparison of daily and monthly curves. These records were first arranged by average calendar months and by average "order-of-flow" months, and plotted. For a power development requiring 170 cu. ft. per second, the calendar month curve indicated a shortage for only one month, amounting to 7 days of full power, while the arrangement by order-of-flow showed a shortage during four months aggregating 43 days of full power.

The daily flow for each year was then plotted, in order of magnitude, and also the average daily flow for the six years. Taking the average curve, it was found that there would be a shortage during 6.8 months aggregating about 3.2 months of full power. Even this average does not tell the exact truth, Prof. Raymond claims, because when the record of any day in any year exceeds 170 cu. ft. per second all the flow above this volume tends to lift the average of the six years, but is itself unavailable for power. To get at the exact truth, it is necessary to make an average in which the flow in every year for each day that has a larger value than 170 cu. ft. per second, must be taken as only 170 cu. ft. per second, until the flow of that year in which the low flow extends farthest reaches 170 cu. ft. Making such an average for these six years, it is found that the shortage will extend over 237 days instead of 208 days, giving an aggregate of about 100 days of full power to be supplied by steam.

The addition to the aggregate determined from the straight average is not large, but the cost of supplying this power is not in proportion to the amount of power supplied. If the steam plant were run constantly with not too large variations in power, the cost would perhaps be somewhat nearly proportional to the amount of power supplied, being determined largely by the quantity of fuel consumed. But where the amount of power to be supplied is very small, the labor item becomes relatively large, and the cost per horse power an hour becomes relatively greater than during those days when the steam plant is run more or less nearly up to its full capacity.

Facing Rings for Pennsylvania R.R. Tunnels.

The cast-iron lining for the East River tunnels of the Pennsylvania, New York & Long Island Railroad Co. are being manufactured by the J. B. & J. M. Cornell Co., New York, at the rate of about 40 tons a day, an amount limited by the rate of progress on the tunnel. The rings are 23 ft. in diameter, 30 in. long and 2 in. thick, and are each made with eleven segments and a key, each 6½-ft. segment weighing about one ton. The segments are cleaned by sand blast, dipped and delivered by trolley to the machine shop, where all flanges are faced. The regular segments are faced in Ingersoll milling machines, each piece being finished separately. Some of the rings are special for use in curved parts of the tunnel, and are about ¾ in. wider on one side than the other. One vertical face and the radial flanges are first faced in the usual manner and then all the segments composing the ring are assembled, faced side down, on the 24-ft. table of a special boring mill designed and built by Mr. Cornell. This mill has three cutting tools taking heavy cuts simultaneously so that the face of the ring is finished in about three hours. The weight of the long and heavy cutter bar beam is not supported by chains and counterweights as is customary, but is held by heavy spiral springs controlled by hand wheels, which have given complete satisfaction. The table is driven by a Crocker-Wheeler motor engaging special outside gear.

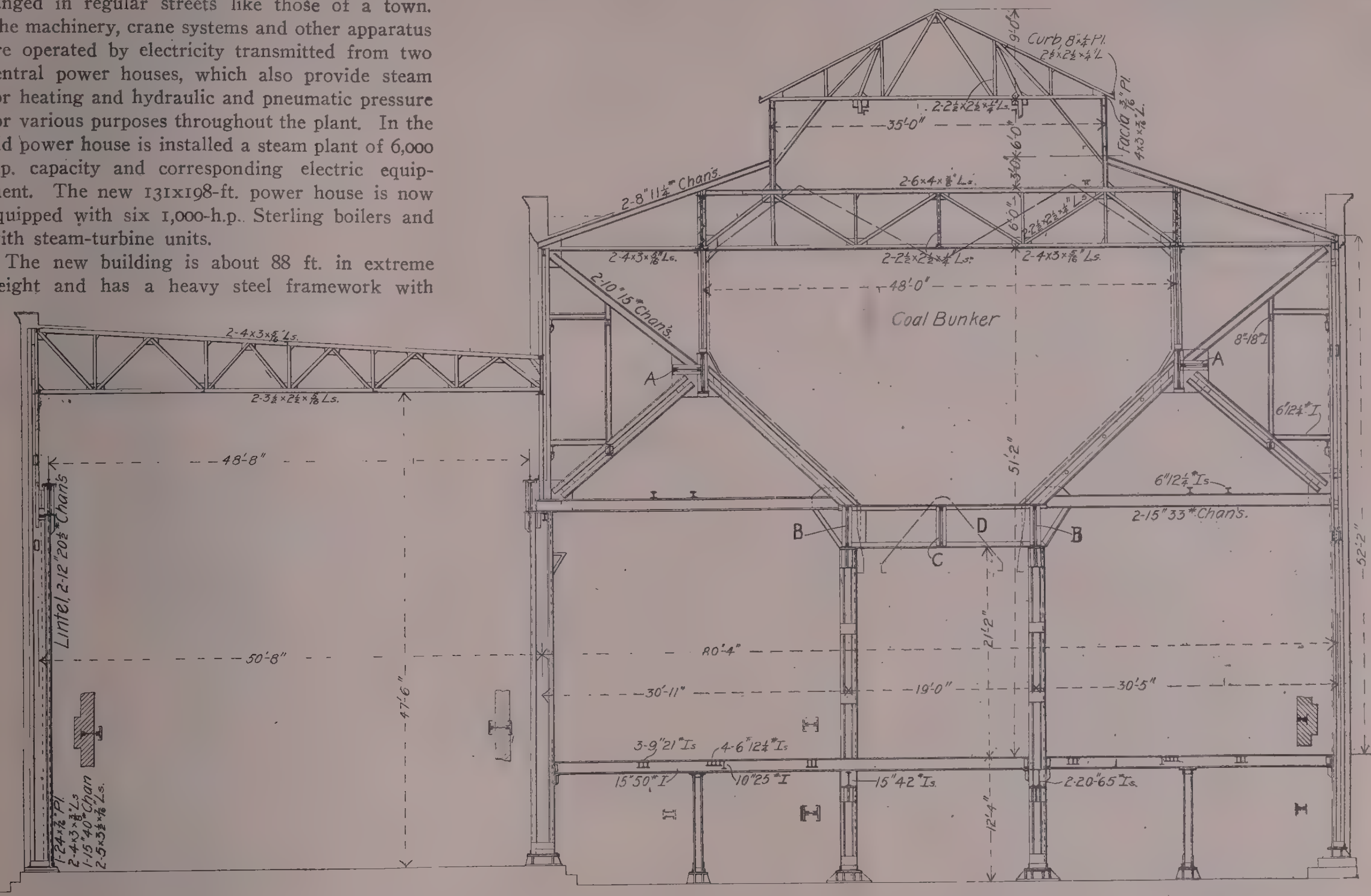


Method of Facing Tunnel Line for Curved Sections of Pennsylvania Tunnels.

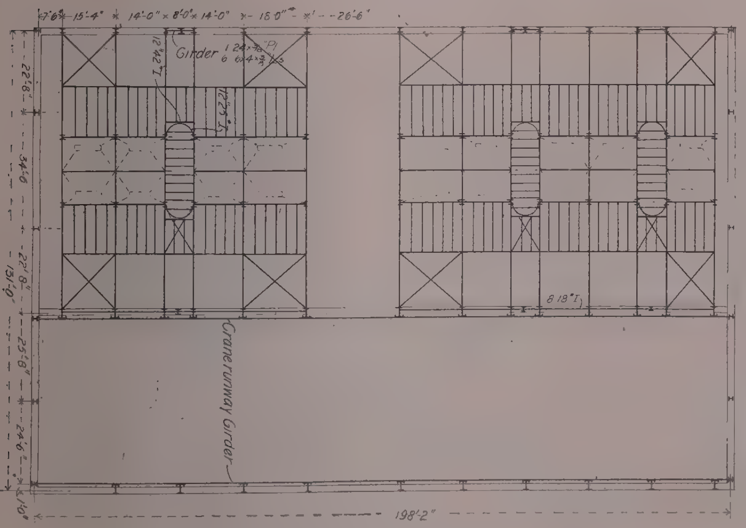
Structural Details of the General Electric Co.'s Power House, Schenectady—I.

The plant of the General Electric Co. at Schenectady employs an average force of 10,500 hands. It occupies an area of about 140 acres, and has a large number of shops and other buildings arranged in regular streets like those of a town. The machinery, crane systems and other apparatus are operated by electricity transmitted from two central power houses, which also provide steam for heating and hydraulic and pneumatic pressure for various purposes throughout the plant. In the old power house is installed a steam plant of 6,000 h.p. capacity and corresponding electric equipment. The new 131x198-ft. power house is now equipped with six 1,000-h.p. Sterling boilers and with steam-turbine units.

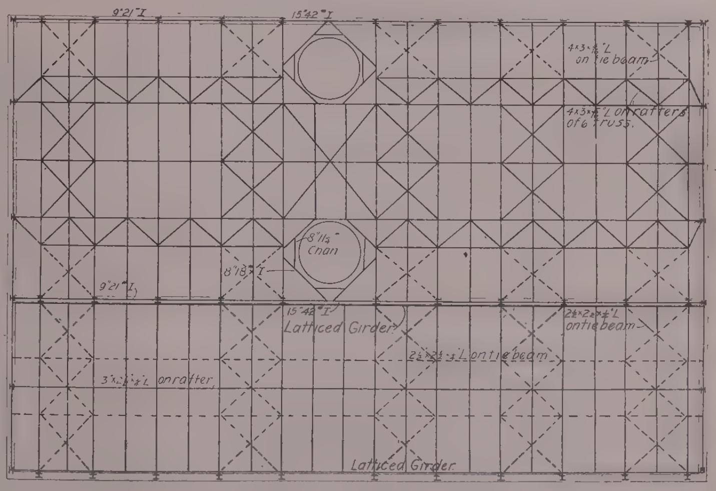
The new building is about 88 ft. in extreme height and has a heavy steel framework with brick walls and concrete floors. It is divided by a longitudinal partition wall into a 50x198-ft. turbine and dynamo room and an 80x198-ft. boiler room. The latter is three stories in height, the basement being occupied by ash hoppers, coal and ash conveyors, stoker drives, pumps, and wash and locker rooms. In the first story are two tiers of boilers, of which 6,000 h.p. are now installed and the remaining 6,000 h.p. are contracted for. In the third story are coal bunkers with a capacity of 26 tons per linear foot. The turbine and dynamo room has a single story 47½ ft. in clear height below the bottom chords of the roof trusses, and is commanded by a 50-ton traveling crane of 48 ft. 8 in. span.



Cross Section Through Boiler Room, Engine Room and Coal Bunker.



Plan of Goal Bunker Framing.



Plan of Roof Trusses.

The main framework of the building consists of fourteen transverse bents, each consisting of roof trusses, and the columns which support them and the coal bunkers, as indicated in the general cross-section, where also are shown the longitudinal girders. Near the middle of the present building there are two Custodis brick smokestacks, 11 ft. in diameter and 200 ft. high, which occupy a special panel between transverse bents. In this panel the main roof is surmounted by a special monitor frame with glass roof, but elsewhere it corresponds to that shown in the general cross-section.

The smokestacks have an estimated weight of 1,200 tons each, which is distributed over a 43½x49 ft. piled surface of sandy soil by a double grillage of crossed 20-in. 65-lb. I-beams from 18 to 24 in. apart about 10 ft. below grade, which are embedded in a solid mass of concrete 5 ft. thick. Each grillage also receives the bases of seven adjacent columns, some of which have loads of 400 tons each. The piles are proportioned for a load of only 12 tons each. These columns have very wide cast-iron bases, which are not seated directly on the upper tier of beams in the grillages, but are separated from them by 4 in. of concrete, and are each anchored by a pair of 1¼-in. vertical bolts on opposite diagonal corners, which pass between the beams of both tiers and have nuts on their lower ends engaging webs of short 7-in. channels transverse to the lower tier of beams, and having their backs in contact with the lower flanges of the beams.

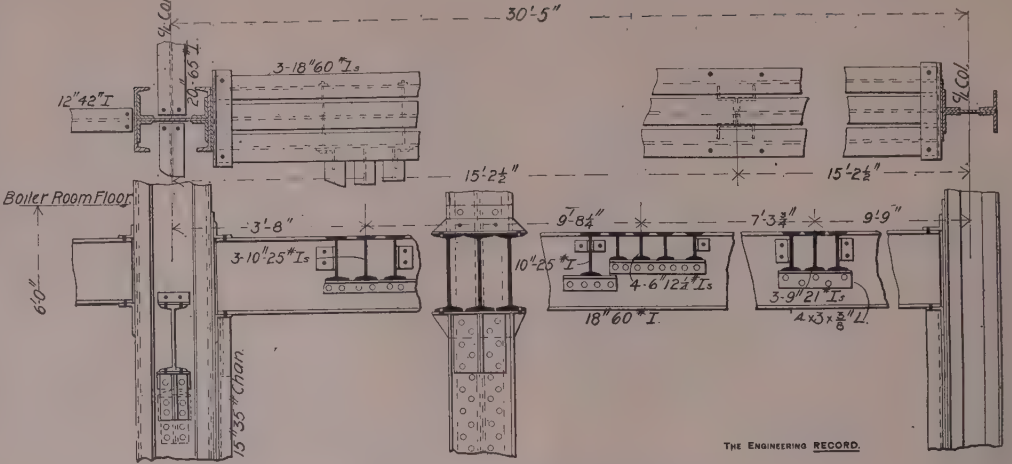
There are in the longitudinal axis of the boiler room three other grillage foundations, each 18½ ft. wide and 39 ft. long, and receiving four main interior columns. Each is made with 16 15-in. 50-lb. lower-tier I-beams 39 ft. long, transverse to the axis of the boiler room, which passes through their centers, and an upper tier of two groups of 5 20-in. 80-lb. I-beams, 19 ft. long, in the middle of each end of the transverse beams. The columns not seated on these grillages have wide cast-iron pedestals set on ordinary battered concrete piers.

The boiler room floor is about 12½ ft. above the basement floor, and is carried wholly by four longitudinal rows of main columns and two intermediate rows of one-story columns. On it the boilers are arranged in pairs on both sides of the center longitudinal aisle. Each pair of boilers is supported by a special set of beams carried by an independent group of nine main and intermediate columns. These groups are separated by the 19-ft. center longitudinal aisle and by 8-ft. spaces between transverse rows of columns, and near the center of the boiler room two groups are omitted and the somewhat narrower panel there is occupied by the smokestacks.

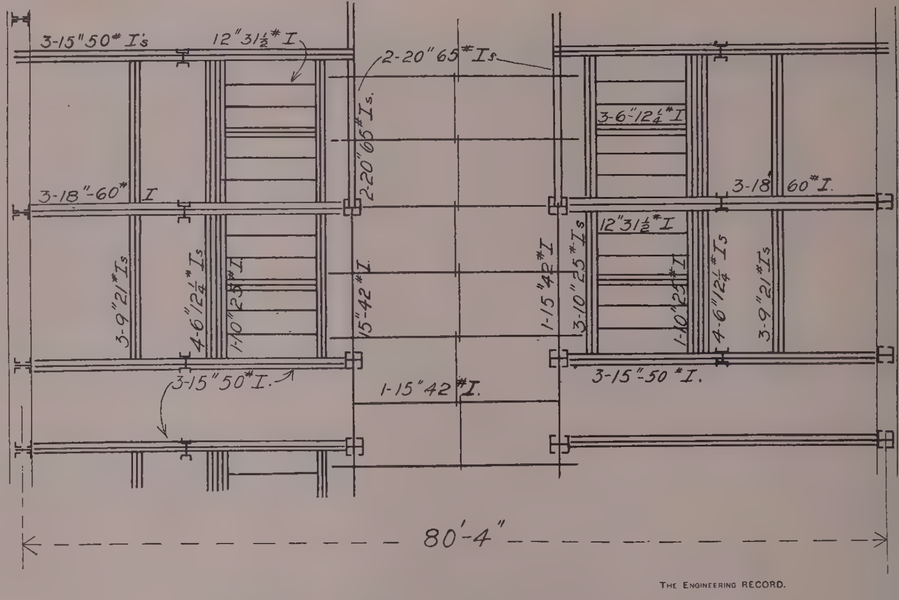
There are in all six groups of beams now set for the boiler units, and space provided in the building for two more full groups and two half groups. The center aisle and the spaces between the boilers are to have concrete floor slabs proportioned for a live load of 200 lb. per square foot. The main transverse girders are each three 15-in. or 18-in. I-beams supported from the columns by shelf angles, with their horizontal flanges bearing on the milled upper ends of vertical distributing angles as indicated in the details. The top flanges of the beams are also connected to the columns by horizontal transverse angles, with field-driven rivets through both legs. Where the beams are symmetrical with the center lines of the columns their connections are very simple, and where they are, as in some cases, eccentric, they are made with projecting bracket plates across the column flanges, or the girder beams are connected to the webs of longitudinal girders in the adjacent panels. The groups of longitudinal beams have their lower flanges seated on continuous shelf angles riveted to the webs of the outside transverse beams, and the latter are connected at these points by horizontal bolts and separators.

The coal bunker is a longitudinal bin extending through the building over the center aisle, except in one panel, where its continuity is interrupted to clear the pair of smokestacks. Both ends and the upper parts of the side walls are vertical, the lower parts of the side walls are inclined inwards to meet the W-shaped bottom, which is arranged to slope toward a double row of scuppers delivering to the boilers on opposite sides of the center aisle. The principal girders in the bunkers are the two upper longitudinal girders *A A*, at the bottom of the vertical parts of the side walls, the three longitudinal girders *B B* and *C* in the bottom of the bin, and the transverse girders *D* at every panel point. Girders *A A* have T-shaped cross-sections made with vertical and horizontal webs, and give lateral rigidity to the bunkers and resist the coal pressure. The manner of their support is novel and interesting, and is so arranged as to provide for the horizontal, oblique and vertical reactions without complicated bracing and without special columns, the weight being distributed between the regular center and side columns.

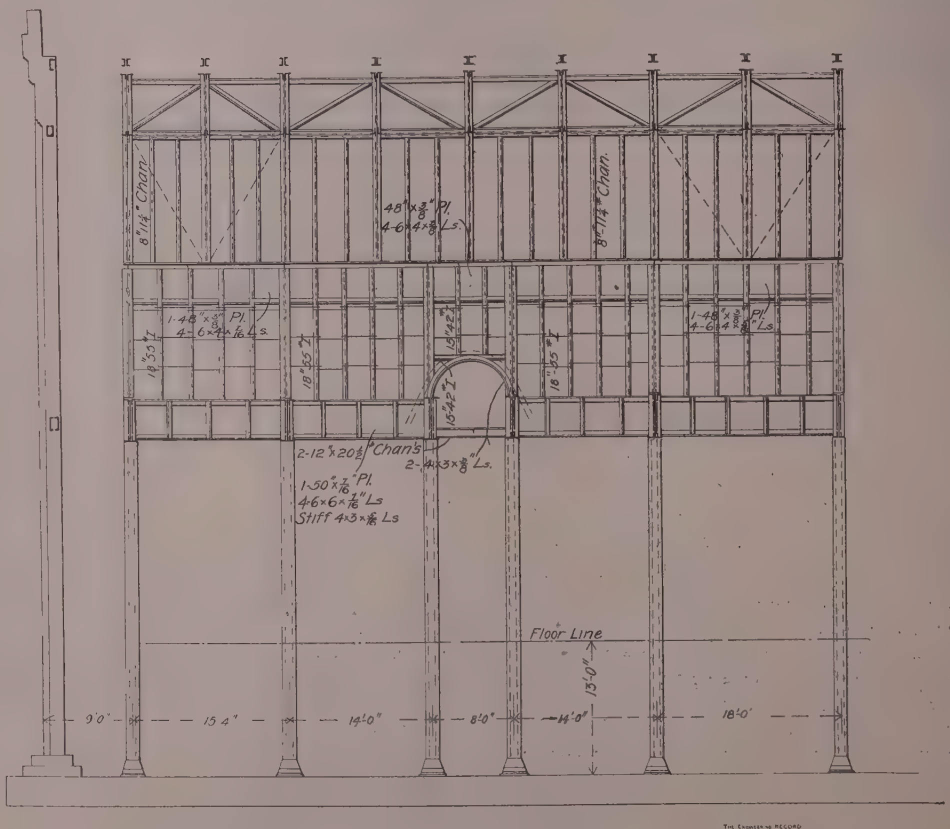
The top of the center column and the top of the lower part of the side column on each side of the bunker in each transverse bent are connected by a triangular truss made with three stiff members with riveted connections to each other and to the columns. The inclined upper members are heavy plate girders which support longitudinal girders, *A*, at their apex, where their webs are integral with the vertical transverse connection



Beams and Girders Under Boiler Settings.



Typical Panel of Beams and Girders in Boiler Room Floor.



Part Center Longitudinal Elevation Showing Coal Bunker Girders.

plate. These points are also braced to the tops of the side columns, and rectangular frames attached to the columns and to the diagonals provide for galleries parallel to the bunkers on both sides.

In the planes of the transverse bents and midway between them the upper longitudinal girders *A A* carry vertical columns which support the transverse lattice girder trusses carrying the roof over the coal bunkers. Their top flanges also support 8-in. vertical channels 3 ft. on centers between the columns, which form the framework for the vertical walls of the bunkers. The lower horizontal girders *D* in each main transverse bent are seated directly on the caps of the center columns and carry the center longitudinal bottom girders, *C*. The outer longitudinal girders *B B* are carried directly by the columns.

Between each pair of transverse bents the bottom of the bunker is divided into two rectangular panels 14 ft. long and 9½ ft. wide by the center girder, *C*, and each panel has a steel hopper bottom terminating in a scupper delivering to a chute in front of each of the boilers. The hoppers are lined with 3 in. of concrete retained in position by horizontal angles riveted across the hoppers and made continuous with the concrete, of about 3 ft. span and 6 in. thickness, which are reinforced with expanded metal and are carried by the vertical and inclined beams in the sides and ends of the bunkers. The vertical end walls and the vertical portions of the side walls are connected to the lower flanges of transverse and longitudinal lattice girders, which act as ties to take internal pressure. These girders support the 8-in. channel rafters which carry the lower part of the roof on each side, and cantilever 8 ft. at the upper ends to join the vertical columns of the monitor trusses. Both the transverse lattice girders and the monitor trusses are X-braced in the planes of their top chords by angles in five transverse panels, as shown in the roof plan, the same system being continued through the roof of the engine room and through the corresponding vertical wall panels to the ground.

Between the smokestacks the adjacent ends of the coal bunkers are braced by a center horizontal girder in line with girders *D* and by two parallel girders offset from the center lines of girders *B* so as to clear the smokestacks. The ends of the latter girders are connected by 3x4-in. horizontal diagonal angles, which are continued through the corners of the bins. Similar corner angles are provided at the other ends of the bins, and at each corner of the bunker form with the outer longitudinal sdie of the bunker two sides of an oblique parallelogram, with its opposite two sides made by longitudinal and diagonal angle struts anchored to the end walls. In the three 8-ft. panels of the framework it was required to carry large steam mains across the building at the level of the bottoms of the bunkers. The regular longitudinal girders *B B* and *C* interfered with this, so in these panels they were replaced by pairs of 3x4x⅜-in. angles about 2½ ft. apart, riveted back to back and forming semi-circular arch ribs seated on the top flanges of transverse girders *D* and covered with concrete, which formed the bottom of the bunker and the arch of a vaulted passage under it.

All of the columns have I-shaped plate-girder cross-sections, and most of their flanges are reinforced by channels riveted on with the flanges turned in. In the regular bents the boiler room wall columns have loads of 133 tons, the intermediate columns under the coal bunkers have loads of 400 tons, the one-story columns under the boiler room floor have loads of 55 tons and 90 tons, the center columns between boiler and engine rooms have loads of 182 tons, and the engine room wall columns have loads of 112 tons.

(To be continued.)

Water Purification Works for Toledo.

Plans have been prepared for a 20,000,000-gal. mechanical filtration plant for the municipal water works of Toledo, O., and a portion of the contracts awarded for the construction of the plant, on which work is to be commenced immediately. The water supply is at present drawn from the Maumee River by pumps in a pumping station 4 miles above the business portion of the city and the water sent directly into the distribution system without purification. The filter plant is to be built 3 miles upstream from the pumping station and will embrace a power and pumping station on the river bank, a purification works 1,000 ft. back from the river and 50 ft. above it, a clear water reservoir adjacent to the purification works and a conduit connecting the new plant with the existing pumping station farther down the river.

The Maumee River has a watershed of about 6,430 sq. miles above Toledo that is largely rolling agricultural land and the water of the stream is typical of that of most streams in the middle west. The water normally carries from 20 to 40 parts per million parts of finely divided clay, but the turbidity is increased at certain seasons of the year to as much as 1,500 parts per million, and during periods of considerable length the turbidity ranges from 100 to 400 parts per million. The character of the water is not generally bad, however, when considered from a sanitary point of view, although the stream is polluted by a small amount of sewage from towns in the watershed. The plant is to be built to clarify the water as much as for a safeguard against supplying dangerously polluted water to the city, and it is considered that any process of filtration that will completely remove the finely divided clay in the raw water will have satisfactory bacteriological efficiency.

The power and pumping machinery station at the river is to be a brick building on a heavy concrete substructure and the machinery in it is to be driven entirely by gas engines, supplied with gas from a producer plant in the building. The gas plant was adopted chiefly to avoid the production of any smoke, as the new works are in a residential district, although with the machinery that is to be operated the cost and efficiency of this type of plant is considered to compare favorably with those of any other type that could have been adopted.

Three gas producers, built by R. D. Wood & Co., of Philadelphia, are to make up the producer plant and will supply gas to gas engines made by The S. M. Jones Co., of Toledo. The pumping equipment will also be built by R. D. Wood & Co., and is to consist of two horizontal shaft, two-stage, 15,000,000-gal. centrifugal pumps direct-connected to vertical three-cylinder four-cycle type gas engines. The pumps have been specially designed to operate efficiently in connection with the gas engines and have three separate impellers and impeller cases, two in the first stage and a larger one in the second stage. One of the first stage impellers is on each side of the larger second stage one and the suction is from both sides of the pump, the first stage impellers discharging into the case of the second stage impeller. The second stage impeller discharges against a normal head of 65 ft. into a rising main leading to the purification works. A 200-h.-p. electric-generating plant in the pump building will furnish power to operate the auxiliary machinery in the filter building and current for lighting the buildings and grounds of the plant. The demand for power to operate the auxiliary machinery in the filter building varies from practically nothing to considerable amounts and a storage battery will be installed in connection with the generators to equalize the demands on them. A 100-h.-p. gas-fired steam boiler in this building will furnish steam for the heating system of the entire plant.

The rising main from the pumping station to the filter plant will be a 42-in. riveted-steel conduit, 1,200 ft. long, and will connect with a well in the filter building. Complete detailed plans have been made for the filter building, but the general specifications permit bidders to submit their own plans for it, and as the bids have not been received no exact design for this building has been accepted. Generally speaking, however, the filter plant will have an immediate capacity of 20,000,000 gal. a day, while all the auxiliary machinery, the coagulating basins and the clear water reservoir are designed for a capacity of 30,000,000 gal. a day. The general arrangement of the plant is such and the capacity of the principal piping connections is sufficient, however, that the capacity of the plant may be increased to 60,000,000 gal. a day without any reconstruction other than additions, nor the displacement of any of the original machinery equipment.

The filter building is to be a T-shape brick structure with an office, laboratories, machinery, coagulant-mixing and chemical storage rooms in the cross of the T. The filters will be in two rows in the stem of the T, with a 5,000,000-gal. coagulating basin on each side and a pipe gallery and operating floor between. The filter tanks and the coagulating basins will be of concrete with the brick filter building resting on them.

A 5,000,000-gal. covered clear-water reservoir, built of concrete, will be placed immediately in front of the filter building and the site will permit the location of two more clear-water reservoirs, making an ultimate clear-water storage capacity of 15,000,000 gal. The filtered water will flow from the plant directly into a 6-ft. concrete conduit, 12,500 ft. long, leading to the pumping station and the piping connection of the clear-water reservoir is arranged so the reservoir will serve merely as a compensator to equalize the flow in the conduit.

The contracts for 7,000 ft. of the 6-ft. concrete conduit have been awarded and construction is to be commenced immediately. The conduit will be built mostly in stiff blue clay and will be largely of plain concrete, but it will be reinforced where the material encountered is of uncertain character. It is to be built at a practically uniform depth of 35 ft., so alternative bids for its construction in open cut or in tunnel were received with the result that the bids for constructing the conduit in tunnel were considerably lower than those for constructing it in open cut.

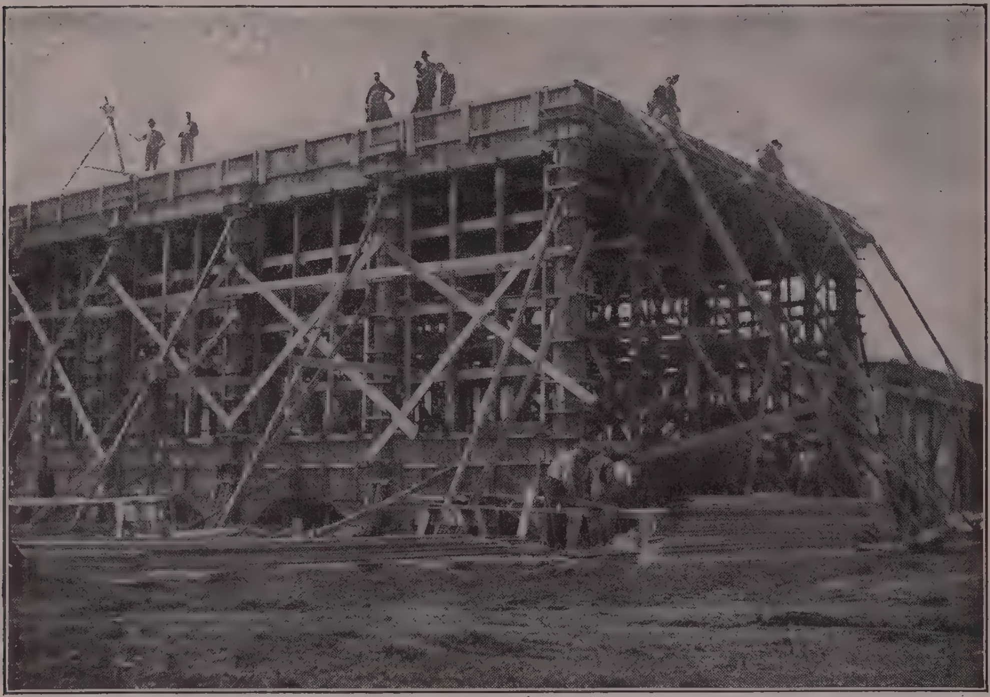
The filter plant is to be built according to the most modern methods and will entail an expenditure of $700,000 for immediate construction, with an additional cost of $100,000 for features that will be added after the part of the plant that must be built at once is completed. The plant will be finished by the middle of 1907, but every effort is to be made to furnish the city with filtered water by January 1, 1907. The work is being carried on by the Board of Public Service of Toledo, Mr. John Stollberry president, Mr. F. I. Consaul, chief engineer, and Mr. Chas. L. Parmelee, of New York, consulting engineer.

A Water-Tower Failure occurred in Waupun, Wis., on Sept. 10. The tower was built about ten years ago and consisted of a stone masonry base 70 ft. high supporting a 24x21-ft. wooden tank. The top of the tower was spanned by heavy timber beams on which were joists placed on edge and held upright by bridging. The bottom of the tank gave way in some manner. After the accident the bridging was found to have failed, allowing the joists to fall over on their sides; whether this preceded or followed the failure is unknown.

Reinforced Concrete Shops and Car Houses, Central Pennsylvania Traction Co., Harrisburg.

By Mason D. Pratt, M. Am. Soc. C. E.

The Central Pennsylvania Traction Co., of Harrisburg, operates a number of city and suburban lines which formerly had four small car houses located at different points. None of these was large enough or properly located to serve the entire consolidated system, and new buildings have accordingly been erected. They include a 75x360-ft. car house having two bays, a 50x375-ft. repair shop, and wings to the latter for a blacksmith shop, storeroom, winding room and steam heating plant. The buildings cover an area of 53,000 sq. ft. and are constructed entirely of reinforced concrete, which was adopted primarily to eliminate fire risks as much as possible.



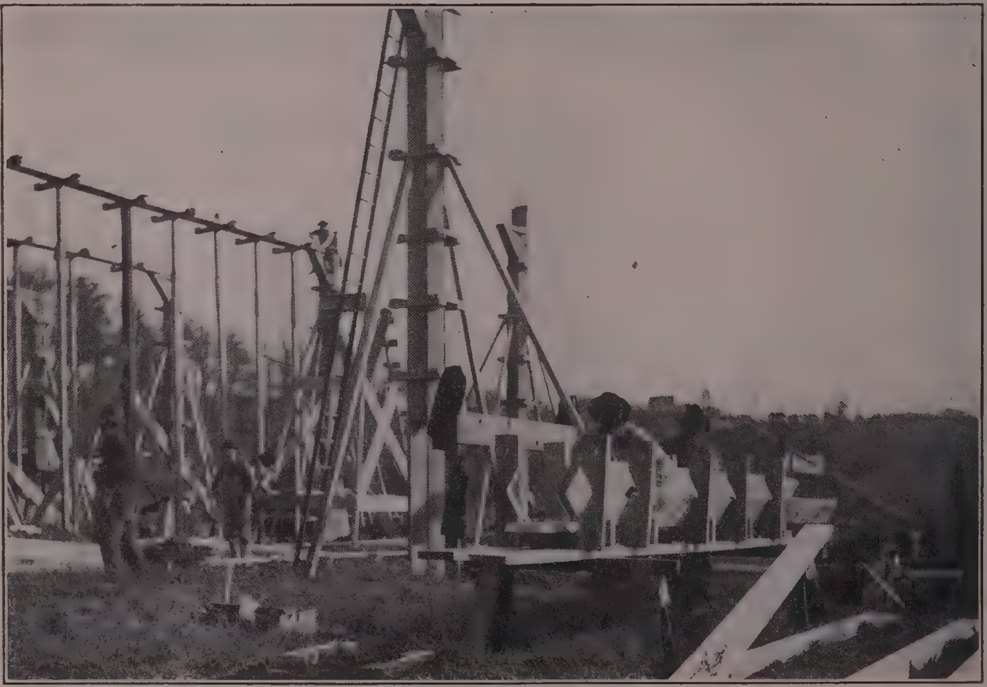
Centering for Shop; Hoisting the Reinforcing Rods.

The car barn building is composed of two bays, each of 37 ft. span center to center, and 360 ft. long divided into 24 bays of 15 ft. each. Each bay contains three tracks on 11 ft. centers, the headroom being 16 ft. 6 in. from the floor to the underside of the roof girder. The shop has a span of 46 ft. 7¼ in. and is 375 ft. long with a 60x72-ft. wing for the blacksmith shop and storehouse, a 19x90-ft. leanto for the armature winding room and an 18x60-ft. leanto for the boiler and heating apparatus.

The surface of the ground on which these buildings are located was from 2 to 10 ft. below floor level, thus greatly increasing the height of the centering supports. The column forms, which were hexagonal in the case of the barn and octagonal for the shop, all with 8-in. face, were built horizontally on the ground and raised by hand. Sufficient lumber was bought for centering up about one-half of the barn building, and, as the concreting proceeded, the first forms were taken down, carried forward and re-erected. The lumber, which was all hemlock, was used as often as six times. In this manner the columns, main girders and roof slabs were constructed, with a longitudinal girder both at the top and the bottom of the columns, which were later utilized as means of holding the wall forms in place.

Concrete was mixed in a Smith mixer, which was moved about from place to place as the construction proceeded, the ingredients being dumped directly into the hopper of the mixer from wheelbarrows. The concrete was made quite wet, and was shoveled into wheelbarrows, hoisted to the roof and carried directly to the point where it was required. The columns were all filled from the top.

The mixture used for most of the work was one part Giant Portland cement, two parts Susquehanna River sand and four parts crushed limestone. Sand was replaced with stone-dust screenings in the roof slab, limestone, the run of the crusher up to 1½ in., being used throughout the work. The roof slab, which was 3 in. thick and laid quite wet, is nearly impervious; the only finish given was one good trowelling, the trowelling following very closely after the concrete gang. All tamping and spreading was done by rakes. In filling the main girders, tamping was done entirely with flat steel sidewalk scrapers, their principal function being to work the mixture to the face of the centering board so as to produce a smooth finish, the result being entirely satisfactory in this respect.

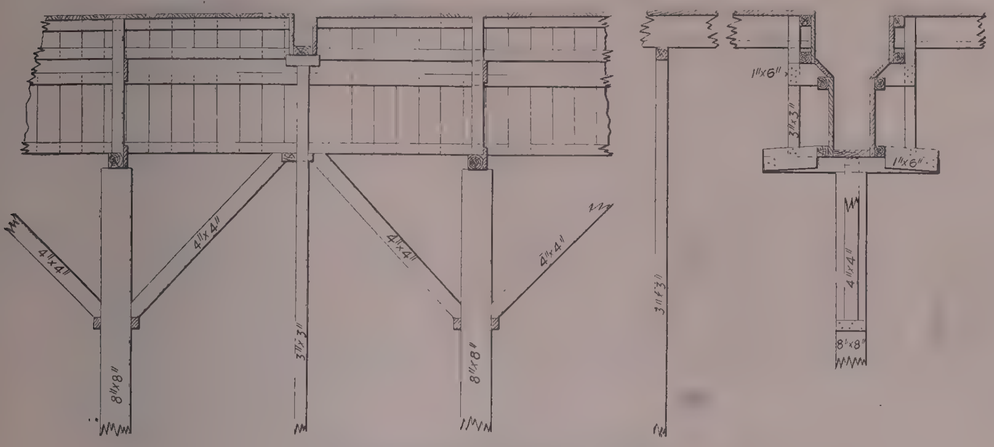


Making Hexagonal Columns for the Car House.

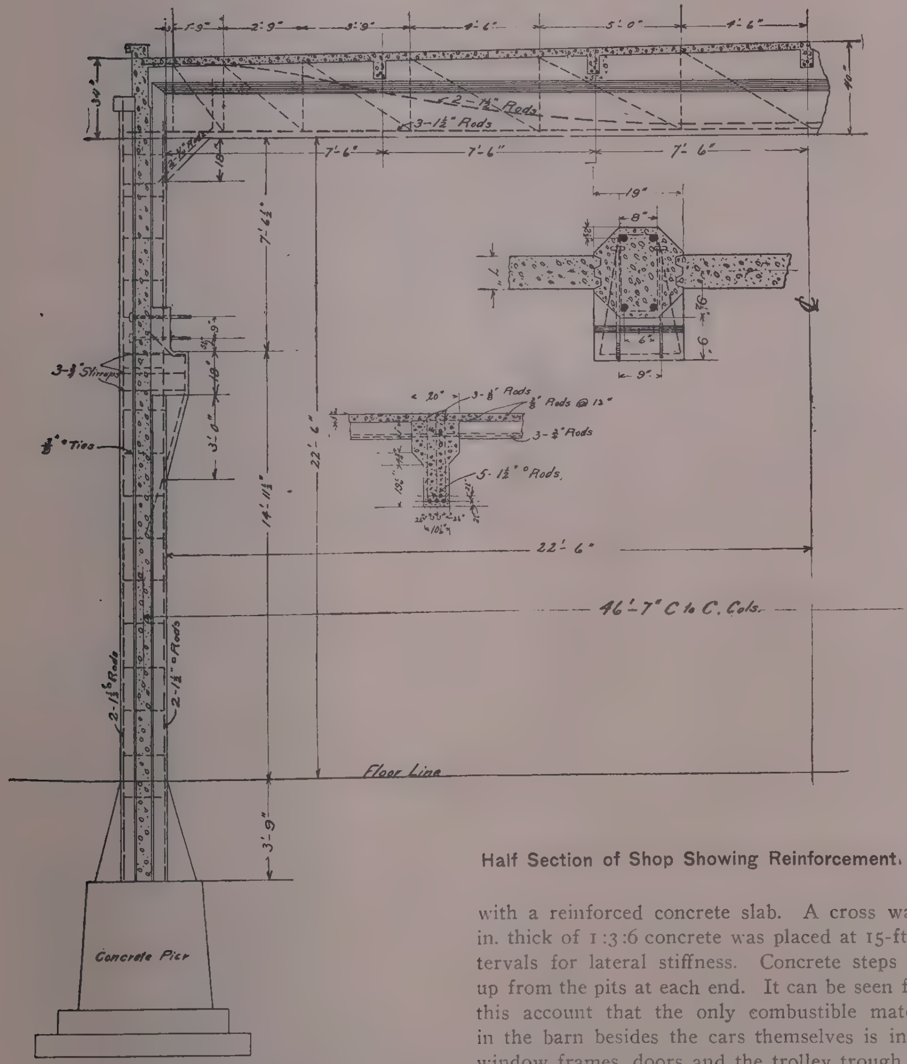
As the barn roof was carried by three rows of columns and the height of the column above the floor was 16½ ft., it was not considered necessary to use any reinforcement in them. The main girders were reinforced with seven 1¼-in. round steel bars, five of which lay parallel to the bottom of the girder and two having their ends raised to the level of the top of the girders. These rods were carried by hangers of special form, made of ¼-in. round iron, the rods being all suspended in the girder boxes before any concrete was placed. This method of placing the reinforcement was not entirely satisfactory, as it was found that even with the wet mixture of concrete, voids would be left owing to dumping too much concrete at one time, and the method of placing a layer of concrete 3 in. deep along the full length of the girders was adopted before placing the rods. This proved more satisfactory. The longitudinal beams supporting the roof slabs are reinforced with three ¾-in. plain round bars, while the roof slab is reinforced with ⅜-in. rods. The roof has a slope of one inch in three feet.

The columns for the repair shop, owing to their greater height and having to carry the eccentric craneload were reinforced with four 1½-in. rods tied together at 18-in. intervals with a bridle of ¼-in. iron formed with a complete loop at each corner, snugly fitting the vertical rods. The crane brackets were further reinforced with ¾-in. round bridles which were attached to the vertical rods near the outer face of the columns. A departure from the usual practice was adopted in the case of the roof girders, in that they were made with a heavy top cord or T section, the reinforcement consisting of five 1½-in. plain round bars on the three lower rods of which was formed a truss of ⅜-in. round rods, the trussing from the center of the beam to the outer end being entirely of one piece, the roof slab being reinforced as on the barn building. The skeleton progressive construction was also followed in this case, columns and roofing being placed at one time and the wall space containing window frames filled in later.

In the car barn the pits under the tracks extend the entire length of the building, with the exception of 45 ft. at the front end of each bay. These pits are open between the two outer tracks and have a concrete floor. An interesting detail is shown in the construction of the pit tracks which are supported on reinforced concrete posts 6 in. in diameter, the reinforcing consisting of four ⅜-in. vertical rods with a 2-in. mesh No. 15 wire poultry-netting cylinder. These posts, of course, could not be made in place. They were cast in octagonal wooden forms similar to the main columns of the building, about 1,000 being required for the whole job.



Mould for Main Girders and Beams.



Half Section of Shop Showing Reinforcement.

In constructing the pits a footing 2 ft. square was made for every post, with a pocket 7 in. in diameter and about 7 in. deep formed for the posts. An inch and a half of sand was placed in the bottom of these pockets in which the concrete post could secure a good footing. This also provided a means for adjusting the height when lining and surfacing the track, the track rails being attached to the posts by means of cast-iron caps. When the rails were brought to line and surface, there was a space of ½ in. between the top of the column and the cast-iron cap. This space and that around the bottom of the post was then filled with a grout, one cement to one stone dust. These posts are spaced 3 ft. 9 in. center to center longitudinally of the building and carry a 6-in. girder rail in the barn and a 7-in. girder rail in the shop. The floor space between tracks was then filled with a reinforced concrete slab. A cross wall 6 in. thick of 1:3:6 concrete was placed at 15-ft. intervals for lateral stiffness. Concrete steps lead up from the pits at each end. It can be seen from this account that the only combustible material in the barn besides the cars themselves is in the window frames, doors and the trolley trough.

The carpenter shop is floored with maple, all other floors being of concrete. The shop building, which was constructed last, is made entirely of stone dust concrete, as it was found that this gave a much denser and stronger concrete and also came from the forms with a smoother surface and sharp corners.

The tests on the 6-in. concrete posts were made on an ordinary wheel press in the car shops to determine their carrying capacity. In order to secure a uniform bearing on the ends, a short piece of wrought-iron pipe was placed over each end, projecting a few inches beyond the column. The annular space between the wrought-iron pipe and the column was covered by a ring of cotton waste and the projecting portion of the pipe then filled with moist sand. The result was highly satisfactory as in every case the column ruptured at some intermediate point. The posts were 4½ ft. long and three to four weeks old. When tested, they showed a crushing resistance of about 1,600 lb. per square inch. Since the testing of concrete mixtures in compression is coming more into vogue, owing to the fact that compression tests will be much more valuable as a guide to the qualities of the concrete which is always used in compression, the writer believes that some such method as the above will be found highly satisfactory in making these tests, as it will not then be necessary to have a perfectly smooth and true face on the test piece, the sand cushion giving a perfect adjustment between the testing piece and the plunger of the press as well as a uniform pressure over the entire area.

The Valuation of Property for Railways.

The Supreme Court of Appeals of West Virginia has recently laid down in Guyandotte Valley Ry. Co. v. Buskirk, 50 S. E. Rep. 521, the following rules for determining the value of property condemned for railway purposes:

In a condemnation proceeding by a railroad company to take the whole of a lot of land for the purposes of its roadbed and station buildings, the compensation to be allowed the defendant for such land is, ordinarily, its market value at the time of its appropriation, without any deduction for benefits or appreciation in value, general and common to the community in which the land is, shared in by all property along the line of the road, and due to the prospect of its construction.

The market value in such case is the price for which the land could be sold in the market by a person desirous of selling to a person wishing to buy, both freely exercising prudence and intelligent judgment as to its value, and unaffected by compulsion of any kind.

Such value is to be determined by the same considerations that enter into a sale between private parties, namely, the availability of the land for all valuable uses to which it is adapted, having regard to the existing business or wants of the community, or such as may be reasonably expected in the immediate future.

What is termed the market value of property in the law of eminent domain is not a value fixed by consensus of opinion in the community in which the land is, or among business men or dealers in real estate who are familiar with it, but is a value to be fixed by the jury, upon consideration of all the evidence in the case, including the knowledge of the property which they have acquired by their view of it.

The opinions of persons residing near the property, and who have known it for a considerable period of time, though not dealers in real estate, nor specially informed as to prices, are admissible evidence on the question of its value.

The price paid for the land by the defendant is admissible evidence of its value, provided the purchase was not remote from the appropriation in point of time.

THE SIMPLON TUNNEL work seems to be pretty well cleaned up, for "Engineering" states that a recent report showed but 18 m. of the top heading, 66 m. of full-section excavation, and 157 m. of lining remained to be executed. A flow of 256 gal. of water per second is still draining away from the southern side.

Welfare Work.

Among the branches of the National Civic Federation none is more generally interesting than that devoted entirely to efforts to interest employers in giving special consideration to the physical, mental and moral welfare of employees in all industries. While much has been done to spread information concerning this work, the authoritative statements of Mr. H. H. Vreeland before the New England Cotton Manufacturers' Association last week deserve special attention as an explanation of the organized endeavor to bring the subject before all employers. The problem is an old one in the textile industry in New England, and is receiving careful attention at some of the new mill towns in the South. The surroundings of the factories and houses are improved, flower seeds are distributed annually and prizes are given for the most attractive gardens. There are kindergartens and classes in domestic duties, athletic sports are encouraged, and various entertainments are provided. These are important developments of the pioneer welfare work at Lowell and Waltham. At the latter place the necessity for such work has largely disappeared since the place has developed from a village into a city, yet the Waltham Watch Co. still supervises its women's boarding house and lends money to its employees in time of stress in order to prevent usury.

Mr. Vreeland called special attention to Vandergrift, Pa., as an excellent example of welfare work for an isolated community sustained by a single industry. Here the drainage system, gas piping, paving, curbing and water supply were installed before the great shop was completed. A system for saving and lending money was promoted by the employer, to enable the men to own their homes. The several religious beliefs were recognized by the erection of eight churches, each with its pipe organ, and there were built schoolhouses, an inn and a social hall. An athletic field was also supplied. In the works there was installed the most complete emergency hospital to be found in any shop in this country; while retail stores satisfy the material needs and meet the tastes of local trade.

A more recent development of welfare work is its application in factories, employing both large and small numbers, in cities. Here the conditions are reversed. The factory, instead of being the creator of the city, is one of its many adjuncts and constituents. Here the problem in its beginning relates more directly to the factory itself, and to the immediate surroundings of the daily work. In the work rooms themselves, ventilation and light are of first importance. These, of course, can best be secured when a new plant is built. Another forward step in the city factory would be the furnishing of a place for the mid-day meal. This may be merely a room where the employees may eat, in the midst of comfort and cleanliness, the luncheons they have brought from their homes, or it may be a lunch room where the mid-day meal is prepared and served. Some other considerations will be seats for women, elevator service for women, rest rooms or emergency hospitals, fire protection, transportation facilities, relief associations, pensions and employees' banks for savings and loans.

It has been said that it is impossible to extend the influence of welfare work into the homes of empoyees in cities. Mr. Vreeland's own experience refutes that assertion. When he installed a library in the club rooms of the Employees' Association of the Metropolitan Street Railway Co., it was his purpose to reach the families. He stated at a meeting where there were 6,000 employees with their families, that it was the desire of the management that the catalogues of the library should go into the home of every married employee. He also announced that if there were a man who had a son or a daughter working for an education and special text books or books of reference were needed, the books would be bought and put in the library upon application. The library is, so to speak, a family concern, and it was turned over at least twenty-five times the first winter. It was astonishing, too, to see the high grade of literature that was taken out.

The relief association of this company provides for a man in case of illness or accident, a pension in old age and at the time of death, a fund for burial. He found that the wife of the average laboring man will always land on her feet, if she is tided over for a few weeks, when the husband dies suddenly.

Mr. Vreeland's own experience as a wage earner having taught him that the unmarried man has no place to go evenings, except a hall bedroom, cold in winter, led him to establish club rooms for the men empoyed on the street railways in New York City. A large percentage of the ten thousand men employed by the company lives in boarding houses. Many are from the country. Thirty years ago, as a brakeman on a steam railway, he was in the same position, away from home and forced to live in a boarding house, such as the railroad terminals and his wages could afford. There was absolutely no place for him in the evenings, where it was warm, except the saloon and the pool room. Accordingly the club rooms his company established include an auditorium where monthly entertainments are given, a library, a pool room and a physician's office. They were used immediately and extensively, and a chance visitor will find the rooms filled every night in the week.

In Pittsburg there is an auditorium in the center of a factory, where the employees are taken once a week at the noon time, which is extended for the purpose, to enjoy a vaudeville performance, often supplemented by an educational talk. This auditorium is also used for operatic performances by employees in the evenings, for Christmas entertainments for them and their families, and for other methods of enjoyment.

An interesting feature of this work is that it has become a specialty. To meet this problem of what shall be done for the welfare of employees under different conditions, the welfare department of the Federation has established a bureau to supply experts, who may study such conditions and recommend efforts for the benefit of the employees. A notable example of the recognition of the need of such specialized effort has been the call upon this bureau by the Isthmian Canal Commission for two men to investigate the needs and opportunities for recreation of the employees of the Government engaged in the construction of the Panama Canal, and to make definite recommendations. The Government found it essential to provide recreation for the men in addition to sanitary measures. It was discovered that, with nothing of interest to occupy their leisure time, the men became lonely and depressed, and subject to the diseases of the tropical climate. To secure a happy, contented, permanent set of men, the Government sought the advice of experts upon plans for recreation.

The successful prosecution of welfare work once installed depends upon its constant supervision The employer and his executive force in the average concern is too much engaged with the routine business to study the needs of the employees or to oversee the conduct of the work which must receive constant attention to ensure interest in its continuance And so, there has appeared what is called in different institutions the "welfare manager," "welfare superintendent," and "welfare secretary," who serves as an intermediary and helps to secure the personal touch which otherwise would be lost in our large business organizations of the present day.

One of the obstacles to the successful prosecution of welfare work is the tendency of the average foreman to "knock" all such efforts. Naturally, the foreman whose special business is to turn out manufactured material at the lowest possible cost, is not impressed with the value of what may have appeared to be sentimental propositions. Recently the president of a company with 25,000 employees asked the Federation's bureau to supply a stereopticon exhibit of efforts of other employers, to secure the co-operation of his foremen. He invited them to a dinner at one of the principal hotels, after which this subject was presented, when their minds were free from business cares. The evening was opened by the employer who expressed his interest in the general subject of welfare work. It was astonishing to note the surprise and interest of these men when they observed views of efforts promoted by many employers throughout the country, and found that welfare work is not a fad, but that it includes practical features with good sanitary conditions as the first object. Naturally, foremen cannot be expected to give a great deal of their time to welfare work, but they can, if not in sympathy, prevent its forwarding.

Foremen's meetings held periodically constitute one of the most valuable features of welfare work. The education of the foreman is essential to peace in the industrial establishment. There is nothing which causes so much disturbance as the narrow overbearing, martinet foreman. Justice and fair dealing must be the basis of all welfare work.

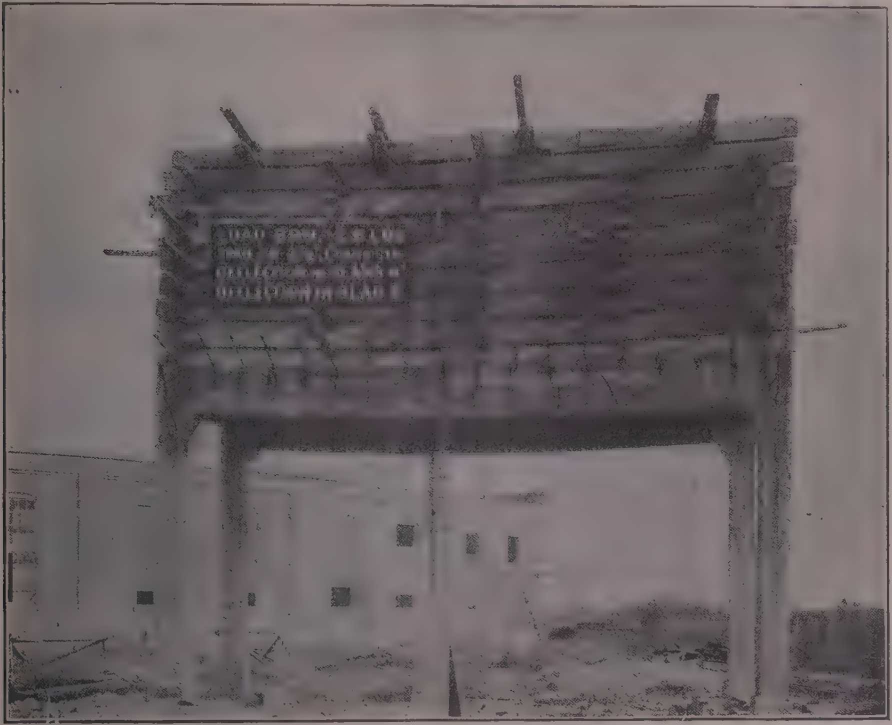
The motive of the employer is one which comes into question constantly. While the economic value of welfare work must be admitted, it is pleasant to find that the average employer promotes welfare work from the humanitarian standpoint. It is not difficult to prove that it is desirable from a mercenary point of view. One may enumerate such advantages as the attracting of skilled employees who will seek work where the conditions are best; good discipline and self-respect, which may be secured through opportunities for cleanliness; a permanent set of employees as against a constantly changing force which requires effort to train and necessitates the loss of much material wasted; and a happy, contented class of workers.

Blowing Wells.

Blowing wells, sometimes known as breathing wells, are now being investigated by the U. S. Geological Survey, and information concerning them will be welcomed by the officers. They have already examined many wells that emit currents of air with more or less force, sometimes accompanied by a whistling sound audible for a long distance. The best-known examples of this type of well are found throughout Nebraska. Blowing wells are also known to occur in Rapides Parish in southern Louisiana. The force of the air current in one of the Louisiana wells is sufficient to keep a man's hat suspended above it. The cause of such phenomena is mainly due to changes in atmospheric pressure or to changes in temperature. During the progress of a low-barometer storm over these regions, the air is expelled from the blowing wells. With a rising barometer, the blowing becomes rapidly less until the current is finally reversed. Differences in the temperature of the surface air and the air in the soil also produce similar effects. When the interstices between the grains of sand, gravel, etc., in which the well is driven are filled with water, the phenomena of blowing are much less noticeable.

Tests of Special Reinforced Concrete Construction in a Roundhouse.

In The Engineering Record of July 22 there appeared a description of a reinforced concrete roundhouse for the Grand Trunk Ry., at Mimico, Ont. When this structure was being built, a test panel was also constructed in December, 1904. The object was to inform definitely the officials of the railway the exact strength of the roundhouse under construction. For this reason the panel was made as nearly as possible like one of those in the roundhouse. This section was rectangular, supported on four columns, one at each corner. These columns were 26 ft. 2 in. on centers one way and 9 ft. the other way. The entire top was covered by a slab 4½-in. thick, supported by girders, and a shallow beam connected the columns across the 10-ft. direction. The reinforcement of the slab, however, extended only between the long beams, the latter carrying the load completely. The girders were 14-in. wide and 20-in. deep below the slab, reinforced each with two 1¼x3¾-in. trussed bars running the full length, and one 1x3-in. trussed bar 10 ft. long, which was bent up at the ends. These bars contained diagonals 24-in. in length and 12-in. on centers. The slab was reinforced with ½x1½-in. trussed bars spaced 16-in. on centers. All reinforcing metal was at least 1-in. distant from the outer edge of the concrete. The four columns were each 14-in. square and 11 ft. high, and were each reinforced with four ½x1½-in. trussed bars, one at each corner, with diagonals pointing towards the center. The concrete was composed of National Portland cement, bank sand and bank gravel, mixed in the proportions of 1:2:4.



View of Test Structure with Maximum Load.

The structure, as outlined above, was allowed to remain for several months, during the construction of the roundhouse. On July 26 it was tested. A bottomless plank box was built on the entire structure, as shown in the accompanying illustration, and filled with gravel until the ultimate strength of the structure was reached.

No perceptible deflection was noticed in this structure until a superimposed load of 200 lb. per square foot over the entire structure was reached. With a load of 500 lb. per sq. ft. a deflection of ½-in. in the beams and 1-in. in the slab was noticed. At 600 lb. per square foot the beam showed a deflection of ⅝-in. and the slab 1½-in. At 700 lb. the first cracks became visible in the beams. These cracks were on top of the beams and practically over the supports, and showed conclusively that top reinforcing bars over all supports should be used in reinforced concrete. When a load of 850 lb. per sq. ft. was reached, cracks appeared along the bottom of the beams within a distance of 2 ft. in either direction from the center. These cracks were almost vertical at the center, but at a short distance away, about where the diagonals begin, they inclined toward the center. They were due purely to bending moment. As the load was increased the deflection became greater and cracks at the center of the beams became more numerous. However, the cracks near the ends over the columns did not become greater to any perceptible extent with this increased loading, but the columns began to buckle outward. This latter was very likely due to eccentric loading on the columns caused by the large deflection of the beams. When 1,000 lb. per sq. ft. was reached there was a deflection of 2¼ in. in the beams and 3¾ in. in the slab. With 1,100 lb. per sq. ft. there was a deflection of 3 in. in the beams and 4¾ in. in the slab, and when a load of 1,260 lb. per sq. ft. was reached there was a deflection of 4 in. in the beams and 6 in. in the slab. At this stage it was deemed unsafe to load any further.

The loading of 1,260 lb. per sq. ft. was reached at four o'clock in the afternoon. The structure continued to deflect very slowly. At six o'clock, without any increased load, the deflection in the beams was 6 in. and in the slab about 8 in. In order to hasten the ultimate destruction at this time, a 1¼-in. rope was thrown over the structure, one end of which was fastened to the T-rail on the ground and the other end tightened, but this seemed to have no perceptible effect.

The ultimate destruction soon followed, however, by the buckling outward of the columns. This was very gradual, and finally the whole structure settled down to the ground, generally snapping the steel in the beams completely in two. In the columns the diagonal shear members were invariably ruptured from the main bar. These main bars were considerably stretched, but were not all broken.

It may be pointed out that this structure was an isolated panel, and therefore could not be considered as strong as if it were incorporated in an extensive structure, such as the roundhouse. This probably caused great eccentricity in the columns when the beams reached their ultimate loading, and therefore the test should not be considered with reference to the columns. The evidence shows, however, that in column reinforcement, as well as in beams and girders, it is desirable that whatever shear or diagonal members are used should be rigidly attached to the main tension member. Unless these two parts are rigidly connected there can be little resistance offered by them to the bending of the column or beam.

The fact that the computation for the roof of the roundhouse, using a similar design to the test slab, was based upon a load of 75 lb. per sq. ft., shows that there was developed ultimately a factor of safety of almost 17. The building was erected by the Trussed Concrete Steel Co., of Detroit, Mich., and the Kahn trussed bars were used for reinforcement.

Central Electric Light and Power Stations in the United States.

The Bureau of the Census has just published a report on central electric light and power stations for the year ending June 30, 1902, prepared under the supervision of Mr. W. M. Steuart, chief statistician for manufactures. It is the third of a series of reports on the operation and utilization of electric current. In addition to the text, which was prepared by Mr. Thomas Commerford Martin, of New York city, expert special agent, there are elaborate tables and interesting series of illustrations.

For convenience in study the various electric stations have been divided into two grand classes: First, those operated by individuals or corporations, and, second, those operated under municipal control. Each of these classes is subdivided into, first, those doing a purely electric business, and, second, those operated in connection with other industries. The latter are designated composite stations. Further subdivisions have been made, one being based upon the population of the place in which the station is located and the other upon the horse-power capacity of the generating apparatus of the station.

The growth of this industry is shown by the following figures: From 8 stations beginning operation in 1881 the number rose to 100 in 1886, to 208 in 1889, and to 247 in 1892. During the following years of depression the number of new stations fell; but in 1895, though a time of financial stringency, it again rose to 239. In 1898 it reached 277, or more than the number beginning operation in the entire period from 1881 to 1886, inclusive. The number for 1901 was 250, and for five months of 1902 it was 146. In the twenty years from 1881 to 1901, inclusive, an average of 165 private and municipal stations have begun operation each year. The spread of the agitation for municipal ownership of public service enterprises is illustrated in a somewhat striking manner. Of the 815 municipal stations enumerated, only 68 had been installed up to 1889. In that year 40 were introduced, and in 1895 the number of new stations reached 73, increasing in 1898 to 82. The returns for 1902 indicate that the ratio was fully maintained in the census year.

In 1902 there were in the United States 3,620 central electric stations, with a cost of construction and equipment of $504,740,352. Employed were 6,996 salaried officials and clerks with salaries amounting to $5,663,580; and 23,330 wage-earners with wages amounting to $14,983,112. The gross income was $85,700,605, comprising $84,186,605 from sale of current and $1,514,000 from other sources. Total expenses were $68,081,375. The total output of stations for the year, in kilowatt hours, was 2,507,051,115. The number of arc lamps was 385,698 and of incandescent lamps 18,194,044.

There has been a striking change in the character of service in these stations. In the earlier days of the industry nearly all the stations were installed for the purpose of furnishing current for arc lighting, while to-day the bulk of current is supplied for incandescent lighting, motor power, and miscellaneous service. This last includes charging telephone exchanges, batteries for boats and automobiles; pumping; hot water, steam, and electric heating; electric current; and nickel plating and electroplating.

Private stations form by far the largest portion of the industry, constituting 77.5 per cent. of the total number of stations in operation during 1902. Their income from sale of current was $78,735,500, or 91.9 per cent. of gross income, the expenses of operation 92.3 per cent. of the total, while they gave employment to 89.4 per cent. of the total number of wage-earners engaged in the industry and paid 90.5 per cent. of the total amount of annual wages. The primary power plant equipment of these stations formed 91.3 per cent. of the total horsepower of all stations, while their generating equipment formed 90.6 per cent. of the total horse-power of all dynamos. The kilowatt hour output of private stations formed 92.2 per cent. of the total, and the arc lamps in such stations formed 86.8 per cent. of the total number wired for operation.

The comparison of the income of the two classes of stations is not a fair indication of their earning capacity, because of the gross income reported for municipal stations. Of this gross income, $6,836,856 resulted from the sale of current and included income from public service which was necessarily largely, if not wholly, a matter of estimation.

The private stations employed 20,863 wage-earners, who were paid $13,560,771, and 6,046 salaried officials and clerks with salaries amounting to $5,206,199; while the municipal stations employed 2,467 wage-earners, who were paid wages amounting to $1,422,341, and 950 salaried officials and clerks, who were paid $457,381.

The cost of construction and equipment of the municipal stations was only 4.4 per cent.; their income from sale of current, 8.1 per cent.; their expenses, 7.7 per cent.; and the horse-power capacity of their power and generating plants, 8.7 and 9.4 per cent., respectively. The output of such stations was 7.8 per cent. of the total kilowatt-hours produced by all the stations, while their arc lamps were 13.2 per cent. and their incandescent lamps, 8.7 per cent. of all the lamps reported for the country.

In addition to controlling practically the entire industry, the average private station is much larger than the average municipal station. Considering the total of 2,805 private stations, it appears that the average total expense per year per station was $22,401, as compared with $6,437 for municipal stations. The private stations gave employment on the average to 7.4 wage-earners, while the municipal stations gave employment to 3. The average private stations reported 823,938 kilowatt hours per year, as compared with 240,373 for the municipal stations.

It is found that 732 municipal stations operated in that number of communities in which there was no competitive private service. It would appear that in all probability a great many if not all of these places would have gone without electric lighting had the supply been left to private enterprise seeking a return upon its investment. The population served by these stations was 2,052,485, an average of a little over 2,800 per station, and towns of this size rarely offer inducements to private capital, regarded from the per capita basis of consumption of current. These stations also represent a total cost of construction and equipment of $15,369,382, or about $21,000 per station, whereas the average cost of construction and equipment for the 3,620 central stations of all classes was slightly short of $140,000. The largest average population per community is shown for Massachusetts, having 17 stations, with an aggregate population of 151,407, or an average of 8,906. The smallest population per community is shown for Colorado, with two municipal stations supplying 1,402 people, or an average of 701 for each station. An average of 5 persons to a family or house would give barely 140 houses.

The largest number of stations was in Illinois, followed by Pennsylvania, New York, Ohio, Michigan, Indiana, Iowa, and Wisconsin in the order named. No other state reached the 150 mark. The New England states were well supplied with stations. Massachusetts reported the largest number, then came Maine, Vermont, New Hampshire, and Connecticut. Among the Southern states Texas led, with Kentucky, Tennessee, and Georgia following. Of the Western states, California reported the largest number of stations, Colorado, Washington, Oregon and Montana being next in order. Of the 1,892 places reported at the Twelfth Census as having a population of 2,500 and over, 1,511 had one or more central electric lighting stations. Of the places with a smaller population, 1,960 had similar stations.

A number of companies supply areas of many square miles in which are located scores of cities, towns, incorporated villages, and mere hamlets, all enjoying the benefits of electricity and constituting a source of income for the enterprise. The extreme limit of such work at the time of this report was marked by the long distance power transmission on the Pacific Coast, where current from the Sierras was actually delivered for general consumption in San Francisco and Sausalito, and was also distributed from the same plants over lines which ramify into half the counties of the State of California. The whole aspect of central station current supply in its relation to population has in reality been utterly changed by the development of polyphase power transmission plants. There are at least a thousand such plants, with lines frequently 15 or 20 miles long, in many cases 40 or 50 miles, often 60 or 90 miles, and sometimes even 150 or 200 miles. These transmission enterprises are peculiarly typical of the far Western states, but are by no means concentrated there, being scattered all over the Union.

The total capital stock and funded debt authorized amounted to $743,296,266, but the amount issued was considerably less, being $627,515,875. Of the total amount authorized, $435,178,372, or 58.5 per cent., was capital stock, and $308,117,894, or 41.5 per cent., was funded debt. Of the total authorized capital stock, $372,951,952, or 85.7 per cent., had been issued at the end of the year covered by the report. Of the capital stock issued, $23,871,671, or 6.4 per cent., was preferred stock and $349,080,281, or 93.6 per cent., was common stock.

Private stations expended $40,050,613 and municipal plants $1,741,834 in construction and equipment during the year covered by the report. The total for private stations from their origin until 1902 was $482,719,879, giving an average outlay of $328 for horse-power of dynamo capacity. It is interesting to compare these figures with those for municipal stations, which show a cost for construction and equipment of $22,020,473, and an average of about $145 per horse-power of generating capacity; it is not safe to accept this average as a basis of comparison, on account of the wide variations revealed in the different states, which range from $114 in Ohio to $844 in the state of Washington.

Although the practice of supplying current for motive power and other uses had grown rapidly, the supplying of current for light was still preponderatingly the business of both private and municipal stations. Of the total income, $70,138,147, or 81.8 per cent., was directly derivable from lighting. The private stations obtained 80.5 per cent. and the municipal stations 96.9 per cent. of their income from this source. This income from the sale of current for lighting purposes was derived from 385,698 arc lamps and 18,194,044 incandescent lamps. The average income per lamp for arc lights in private stations and used for commercial or other private lighting was $48.88; used for public lighting, $83.20. In municipal stations, for commercial or other private lighting, it was $41.46; for public lighting, $69.98. The incandescent lamps in private stations in commercial use earned an average income of $2.40 per lamp; in public service, $6.06. In municipal stations these lamps earned $1.92 in commercial and $5.93 in public service.

The total expenses for private and municipal stations were $68,081,375. Of this, $20,646,692 was for salaries and wages; $22,915,932, for supplies, materials, and fuel; $11,895,206, for rents, taxes, insurance and miscellaneous expenses, and $12,623,545, for interest on bonds.

This subject is considered under the three heads: Power and generating equipment, line construction, and service line equipment. The power plant equipment showed 5,930 steam engines with 1,379,941 horse-power, and 1,390 water wheels with 438,472 horse-power; and the generating plant equipment, 3,823 direct current constant voltage dynamos with 442,446 horse-power; 3,539 direct current constant amperage dynamos with 195,531 horse-power; and 5,122 alternating and polyphase current dynamos with 987,003 horse-power. The line construction had 107,263 miles of mains and 17,880 miles of feeders. For the service line equipment, meters, lamps, and motors are the important items. There were 582,689 meters; 575,004 of these were mechanical and 7,685, chemical. The aggregate of arc lamps of all classes was 385,698, of which 334,903, or 86.8 per cent., were operated from private stations and 50,795, or 13.2 per cent., from municipal stations. In addition to these 385,698 arc lamps connected to the circuits of central stations, the street railways operating electric lighting stations reported 33,863 arcs, making the total for the United States 419,561.

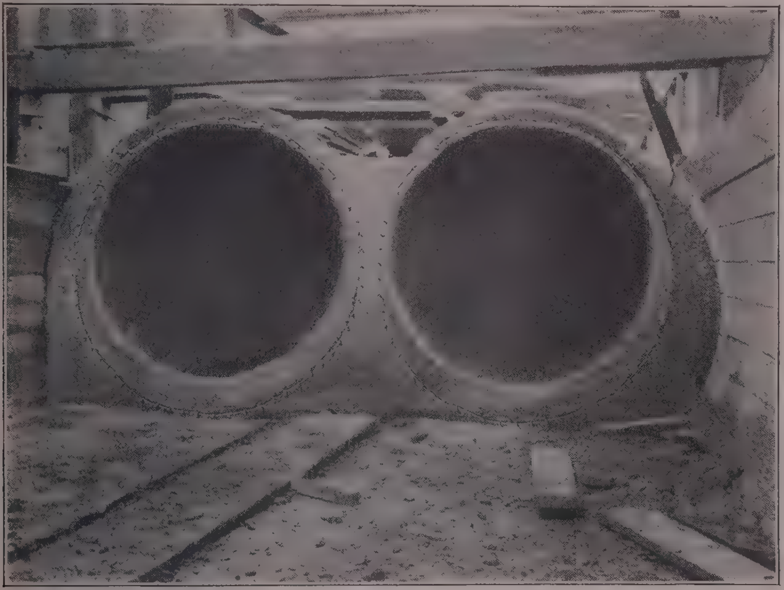
The main function for which a central station exists is the generation of current, for the measurement of which the kilowatt hour is the unit now universally accepted. Using this as the unit, the average output of current per day for all stations was 6,960,783, making a total for the year of 2,507,051,115. For private stations the output was 2,311,146,676 kilowatt hours, and for municipal stations, 195,904,439. Among the private stations the totals for New York are at the head of the list; among the municipal, Illinois.

Ventilation Arrangements of an unusual character are provided in a building for nurses at the Erie County Hospital, Buffalo. It is an 82x73-ft. structure with basement, three stories and attic. The second and third floors each have 15 steam-heated bedrooms. Each room is ventilated through a register 6 in. above the floor, connecting with a flue leading to a fan in the attic. This is a 50x24½-in. Buffalo fan belted to a 2-h.p. General Electric motor. When the fan is not running the air escapes through a roof vent.

Reinforced Concrete in a Baltimore Power Station.

The new power station of the Baltimore Electric Power Co. furnishes some good examples of the important uses of concrete in such a building. This station is about 72x180 ft. and 70 ft. high, and was designed by Mr. James B. Scott. The equipment comprises Stirling boilers with superheaters and Westinghouse-Parsons turbo-generators. The floors and roof are of concrete reinforced with Clinton electrically welded fabric, and the coal bunkers are of the same material in slabs of 6 in. thickness and 5 ft. span. One of the interesting features is the protection of the steel beams in the battery room with a reinforced concrete casing. Owing to the possible accumulation of hydrogen in this room, the danger of fire is greatest here, and the protection of the steelwork accordingly received particular attention.

The circulating water conduits supplying water to the condensers from the bay, about 600 ft. distant, are 5 ft. in diameter inside, and have the cross-section shown in the accompanying illustration. These conduits are buried under 30 ft. of clay, and the reinforcement is placed on the under side of the 4-in. crown to resist this pressure. Toward the bottom of the conduit the reinforcement of Clinton fabric is spread outward so that at the bottom it is 12 in. above the base of the concrete. This is done to resist the upward pressure of the water when the conduit is empty.



Circulating Water Conduits, Baltimore Electric Power Co.

THE REINFORCED CONCRETE REGULATIONS of the Fire Offices' Committee, the British equivalent of the National Fire Protection Association, classify as standard fire resisting construction concrete buildings reinforced in every part with bars not less than 12 in. apart and "securely connected or overlapping at least 6 in. at all abutments and intersections." Concrete may be composed of sand and gravel that will pass through a ¾-in. mesh, broken brick, burnt ballast, furnace slag, clinker or other similar hard and burnt material. At least 6 cwt. of Portland cement must be used in each cubic yard of concrete. No external wall is to be less than 6 in. and no party well less than 13 in. Flues must be at least 4 in. thick and lined with fire clay tubes not less than 1½ in. thick. Floors must be at least 5 in. thick and roofs 3 in. Reinforcement must be at least 1 in. from the surface, but need not be more than 2 in. Enclosures for staircases and elevator wells must be at least 6 in. thick.

Factors in Asphalt Paving Construction, Maintenance and Cost.

A paper read before the League of American Municipalities by Andrew Rosewater, City Engineer, Omaha, Neb.

The first asphalt pavement in the world was laid in the city of Paris about fifty-one years ago. About six million square yards, or about three hundred miles of European streets, are now paved with that material.

Twenty-five years ago about twelve miles, or less than one-fifth of 1 per cent., of the paved streets of the cities of the United States were paved with asphalt. Today about twenty-five hundred miles of streets in the United States, embracing an area approximating forty-four million square yards, are paved with asphalt. This represents in first cost an investment of $100,000,000, and including the cost of repairs and resurfacing, a total outlay of not less than $150,000,000.

Independent of the materials used for resurfacing and maintenance, the materials comprising the asphalt pavements of the cities of the United States would fill over one million cars, enough to make a train six thousand miles long, extending from New York to San Francisco and back, aggregating twenty-two million tons, divided about as follows: Stone, 11,462,000 tons; sand, 7,568,000 tons; cement, 1,386,000 tons; stone dust, 726,000 tons; asphalt, 726,000 tons; oil, 132,000 tons.

Classifying by percentages, the materials comprising an asphalt pavement of 6-in. concrete base, 1½-in. binder and 2 in. of asphalt topping, as usually laid, will run approximately as follows: Stone, 52.1 per cent.; sand, 34.4 per cent.; cement, 6.3 per cent.; stone dust, 3.3 per cent.; asphalt, 3.3 per cent., and oil, 0.6 per cent. Thus it will be seen that asphalt covers not to exceed 3.3 per cent. of the materials of an American asphalt pavement, and ranges as low as 1.8 per cent., when asphalts rich in bitumen are used. Fully 90 per cent. of the American asphalt pavements may be termed artificial bituminous sandstone, the wearing surface being 90 per cent. sand and 10 per cent. bituminous mastic.

The European asphalts, until within a few years ago, were all made from the crushed powder of a natural limestone, of which 90 per cent. is very finely ground limestone and 10 per cent. is bituminous mastic. These asphalts were compact, but very slippery,—the gradients upon which they can be used being limited in consequence. This, in the early literature upon asphalt pavements, gave rise to the statement that they could not be used upon greater than 2 per cent. grades. Experience has demonstrated that the American asphalt pavements are practical for any traffic upon grades up to 5 per cent., and with short sections at intervals upon grades very much steeper; in fact, as steep as 12 per cent.

Until within a few years the wearing capacity of an asphalt pavement was considered so limited as to confine its use to parks and light traffic streets. Pavements laid in European cities, notably in Paris, by an American company in 1886, based upon the sand and bituminous composite, failed completely to meet the dense traffic encountered, and within six months after being laid the remnants were ordered removed.

Within the past ten years successful asphalt pavements have been laid by the same American company in London, Glasgow and Paris, and the granite pavements of several New York city streets have been successfully and satisfactorily displaced with American asphalt pavements.

Up to 1893 asphalt paving specifications within the cities of the United States were practically closed to the use of all asphalts but one, that coming from one portion of Trinidad Island, on the South American coast. From 1881 to 1893 the price of asphalt pavements, with 6-in. base and 2½-in. topping, notwithstanding material reductions in cost of materials and labor, remained constant at about $3 per square yard, with a five years' guarantee. The quality of pavements was not uniform; the same contractor very often laid a good pavement on one street and a very poor one on an adjoining street, under the same specifications. Much mystification was indulged in and only the trade was accredited with possession of the secrets of a good asphalt pavement. The engineers of our cities, in view of their limited knowledge of the subject, in preparing specifications, placed dependence mainly upon the guaranteed period of maintenance, allowing each bidder to prepare his own formula for proportioning and preparing mixture. Inspection, to a great extent, on the asphalt portion of the pavement was a farce. Few cities maintained a laboratory, and where laboratories were maintained the requisites of a successful pavement were unknown or misunderstood.

The question as to the influence of the subbase, the construction of the concrete, the nature of the sand, extent of filler in the sand voids, the amount and nature of bitumen, kind of oil for fluxing, were all partly understood and seldom were results similarly obtainable, except by mere accident of chance. Believing that better progress could be made and lower prices obtained by opening the specifications for asphalt pavements to competition, the author of this article, in 1893, prepared specifications for the city of Omaha, admitting all asphalts under the usual bond and guarantee provisions. To succeed in such an effort it became necessary to induce Washington, New York, Chicago, Denver and other cities to co-operate. This was done and proved successful. All sorts of litigation followed. Each attempt of those early in the field was met with costly and stubborn resistance, but the opposition to open specifications proved futile, and ultimately developed a field for asphalts from the mines of California, Utah, Kentucky, Venezuela and other localities, in addition to those of Trinidad. The prices, as a result of bitter competition for a time, became ruinous to all concerned. The cost of paving dropped, in 1895 and 1897, in many localities fully 60 per cent. The scarcity of expert knowledge brought with this competition some very poor as well as very good pavements. But the public was the ultimate winner, from the more general knowledge gained and the more thorough investigation on the part of all in their endeavor to develop a pavement that would excel others in quality and durability. The outcome is not only better pavements from the Trinidad product, as shown by the success in the congested traffic streets of New York, Paris, London and other cities; but also a keener knowledge of the whole subject, and good pavements are now made from artificial asphalt produced from residuums of the California oils, and also from asphalts from Venezuela, Cuba and numerous other sources.

The engineering profession has, in the past decade, also been admitted into the secret sanctuaries of the laboratories, and has discovered that, aside from the shape of the streets and the asphalt used, the sand, which constitutes 90 per cent. of the surface covering, exerts very much influence upon the result. Numerous analyses of poor pavements have shown that it was not always wise to let the bidders make specifications, and that many important requisites should be provided for in the specifications. In place of 6 and 7 per cent. of bitumen in the asphalt mixtures frequently found in poor pavements of our cities, it has been demonstrated that good pavements should have at least 10 per cent. of bitumen. This applies equally to bituminous limestone pavements as to bituminous sandstone pavements. Careful study of the materials, systems of construction, etc., requisite further shows that the more compact any pavement is the better its wearing qualities, so it is found essential that to secure the minimum of voids in the sand the grains should be so graded as to admit of packing, and finally, after this, the further addition of fine powdered filler will make the mass still more compact. Stone dust has been and is largely used for this purpose, but in larger quantities than in years past, and as an improvement, finely ground Portland cement is being substituted in place of the stone dust. This has been used, with evidently very excellent results, on the Fifth Ave. pavements in New York and those of London, and the same filler was used on Sixteenth St., the leading thoroughfare of Omaha, and is required in all pavements now laid in that city, to an extent of not less than 5 per cent., and 12 per cent. will probably be required in the specifications hereafter. The difference in cost of a few cents per yard will not justify its exclusion on economical grounds.

With these facts bearing on the history of its development and relative to the materials needed in asphalt pavements in view, the factors which enter into the construction of an asphalt pavement, its maintenance and cost can more readily be comprehended. In this class, as in all other pavements, the first essential to good, durable construction is a proper base. A good earth road requires, first of all, proper drainage, both for surface and sub-surface. The solution of this feature is a simple engineering proposition. The next essential is consolidation—the more compact, the less will the surface yield to vehicle traffic, and the greater is its durability. The fact that earth yields readily to the softening and dissolving influence of water demands a very high crown upon an earth road that it may shed water as fast as possible to escape its softening agency. The fact that it partly dissolves when wet makes a soil yield more readily when porous because these voids will quickly absorb, or fill with the dissolving agent; hence the more compacted and less porous, the less it will be exposed to moistening influences.

Again, if the earth roadbed is subjected to water from beneath the surface, it will not only be undergoing constant change in the summer period, but when winter comes the water, when freezing, will expand and heave up the surface. With these fundamental principles outlined, we next come to the pavement proper.

Divested of all verbiage, a pavement is a veneering or wearing road surface. It is placed there to protect the base and give it durability. The early attempts at pavements were of the old Roman road order, consisting of layers of large blocks of stone in mortar, which distributed the load over a much wider area than that directly exposed to the tires of the wheels. These roads have numerous variations, such as slabs of granite laid in parallel rows for the wheels to run on; tram railways, with iron or steel surfaces distributing their loads through the medium of ties or planks to the earth surface; the macadam roads developed about 100 years ago, with depths of broken stone, varying with the traffic, and depending for their efficiency upon compacting the aggregates, first on the traffic, which took years, and later upon great road-rolling machinery, which crushed and forced the various aggregates to a wedged and compact mass, developing a smooth surface.

It was contended, even by railway builders, that roadbeds should have a certain elasticity to be practical. It is now clearly demonstrated that the firmer and more unyielding the foundation, the more durable it will be. The toughest steel, bent back and forth by continuous vibrations, will break. Rock foundations, yielding to compression impacts, will ultimately crush the particles, and the greater and more numerous the voids, the quicker the change of shape and final destruction. The theory of the need of elastic foundations is erroneous; the elastic requisites should be in the spring of the carriages and rolling stock, and not the roadbed. The construction of the so-called bitulithic pavement, which is really a macadam with a bituminous binder, recognizes the need of reducing voids by grading the aggregates so as to reduce the voids from 40 to below 20 per cent., and finally fill this 20 per cent. with tar or other bituminous binder.

In the construction of macadam pavements it is conceded that next to the earth road the need of a large crown is imperative. Why? For the same reason as in the case of an earth road: to shed water so as to minimize its destructive effect. Experience has demonstrated that, all things considered, the most economic covering for road purposes upon soil capable of immediate consolidation into monolith form is a concrete of sand, cement and stone. Unlike the old Roman road, this can be made more uniform, with less material and skilled labor, by the use of small broken stone, which, with various grades of sizes and the mortar of sand and cement, produces a compact and uniform mass.

The more ready action of the elements upon what is known as natural cement makes the so-called Portland cement preferable for exposed concrete work. Its great cost, until within the past few years, has barred its use largely in our paving works. Since, however, its cost has been largely reduced by the increase of its manufacture in this country, its advantages for paving are recognized and its use is becoming more general.

Concrete as outlined could be made for country roads and pavements were it not that the broken limestone soon wears smooth, and, like the European asphalts, becomes too slippery. For this reason, thus far, it is used as an intermediate layer to distribute the wheel load to the earth. Whenever the upper three or four inches can be economically made into a composite of cement and sand, with provisions to resist the forces of expansion and contraction, we will have a sandstone monolith pavement able to continuously resist the action of water, and yet furnish a footing which never can become slippery. Until then a composite covering of sand with bituminous cementing material known as asphalt will be used.

The factors of a good asphalt pavement are:

(1) A good sub-drained compacted base.

(2) An intermediate monolithic material, preferably Portland cement concrete, to rest upon and transmit the load uniformly to the earth below.

(3) An asphalt covering of wearing capacity capable to meet all traffic conditions and to resist the destructive agencies of extreme temperatures and other climatic influences.

To meet requisite No. 3 we are confronted with such varied and conflicting opinions that it becomes necessary to carefully analyze all pros and cons and impartially accept and reject what is good and bad out of them. First of all, let us consider the governing elements.

First.—The asphalt covering must be compact and hard enough at all times to meet traffic requirements.

Second.—It must not be readily affected by water.

Third.—It must be durable.

Fourth.—It must retain its smooth form and not become wavy.

Fifth.—It must not be slippery.

In order that requirement No. 1 be met, the component elements of the covering must be such as to become a solid, voidless mass that can resist compression of traffic and expansion and contraction of temperature extremes.

Experience has shown that asphalts from Trinidad, Venezuela, California and numerous other sections of the country, 60 per cent. of whose bitumens are soluble in boiling naphtha, possess sufficient adhesive cementing qualities to make a proper paving cement. Experience has further developed that the actual and necessary quantity of bitumen thus soluble to make a proper paving mixture shall range between the extremes of 10 and 13 per cent. by weight. The exact proportion will vary between these figures, dependent upon the nature of the sand grains and voids in the sand. The specifications should, to insure good results, provide that not less than 10 per cent. of bitumen shall be required in the mixture. This does not mean 10 per cent. of asphalt, for what is known as refined asphalt varies in the degree of refinement. Bermudez, Venezuela or California asphalts are, when refined or manufactured, free from sand or other mineral mixtures, and, therefore, contain from 95 to 99 per cent. pure bitumen. The Trinidad asphalt, as refined, contains fine, impalpable mineral powder to the extent of 36 per cent. In the latter case it requires more asphalt to produce the 10 per cent. of bitumen, but, on the other hand, the amount of filler of stone dust or Portland cement required with this asphalt is proportionally less than with the others.

The common method of comparing asphalts according to their alleged purity, based upon the bitumen they contain, is both erroneous and calculated to deceive. It is attempted by so-called anti-trust contractors versus the so-called trust contractors. As a matter of fact, the quantity of bitumen in the commercial asphalt product is simply a commercial question which is governed by freight and other factors. Pavement mixtures, laid with an asphalt containing 90 per cent. bitumen in its commercial form, are no better nor worse than mixtures from an asphalt containing 5 per cent., as in each case 10 per cent. of extracted bitumen of a specified quality is required and used in the mixture. In the Manhattan borough of New York, and a few other cities of the country, the specifications for asphalt pavement exclude asphalt, which, in its commercial form, contains less than 90 per cent. bitumen. Such specifications do not protect the public against poor pavements, but increase their cost by excluding competition. As an illustration, I need but to cite a case recently in the court at Lincoln, Neb., where, to exclude the use of Trinidad asphalt in the interest of a certain competitor of the company handling that material, the specifications were so drawn as to prohibit the use of any asphalt in the proposed pavements which in its commercial form had less than 90 per cent. bitumen.

The testimony of Chief Inspector Dow, of Washington, in this case was that this clause did not insure good asphalt, for its provisions would exclude Cuban asphalt, which produced among the very best, if not the best, asphalt pavements laid in Washington. His testimony showed that Cuban asphalt contained only 70 per cent. bitumen in its commercial form. Whilst it is well for cities to guard against trusts or any form of combinations, the fact that asphalt has been and could readily be bought in the open market from numerous sources for several years past disposes of the trust question, and the anti-trust cry, so vehemently indulged in by some in relation to asphalt, like the cry of "wolf," should be cautiously listened to by municipal authorities.

In evidence of the delusive representations as to asphalt trusts, the author of this article had occasion, during the year 1904, to visit the cities of Winnipeg, Man., and Detroit, Mich., two cities which own their own plants, and found that asphalts of every brand were obtainable. The city of Omaha, which is now operating its own repair plant, advertised for bids last spring and received proposals from California, Bermudez and Trinidad pitch lake asphalt dealers, at prices ranging from $19 to $26 per ton.

In view of these facts, it is clear that municipal interests are best subserved by providing specifications calling for open competition as to asphalts, and asphalts of requisite quality can best be obtained by providing for the minimum of bitumen in their mixtures subject to the boiling naphtha test, which determines the malthene or petrolene components which constitute the cementing quality of asphaltic bitumen.

Another feature of considerable comment upon which opinions are as varied as there are interests is the claim of susceptibility of certain asphalts to the effects of moisture, and which, for that apparent reason, are used as a basis to exclude asphalts and thereby favor certain contractors and punish others. From practical contact with the varied features of this question, I am led to regard specification provisions placing power in boards or officials of boards to discriminate on grounds of the above nature, as far more dangerous to the honest public service than any possible short-coming affecting longevity of pavements from such alleged effects. The asphalt pavement does not exist which can withstand continued exposure under water without deterioration. Asphalt pavements, when under water a length of time, become more or less soft, and the great deterioration resulting from water upon asphalt pavements is the action of wheels and horses' hoofs upon the softened surface. Sandstones when wetted and exposed to abrasive forces act like grindstones wearing away rapidly as the grinding goes on whilst being subjected to moisture. This is equally the case with the bituminous sandstone. Chief Inspector Dow, of Washington, who is, perhaps, the ablest exponent and originator of the dangerous clause giving preference to asphalts not readily affected by water, informed the author of this article last summer, when extending him many courtesies on an inspection tour of Washington pavements, that for the past seven years all gutters on asphalt paved streets in the Capital City had been paved with vitrified brick. Mr. Dow must have concluded that all asphalts deteriorate more rapidly when subjected to water influences and had little faith in the theory that certain asphalts were not readily affected by water, or he would not have urged the exclusion from use of asphalts alleged to be affected and then studiously avoided using those of preferred merit in gutters where they would be exposed to moisture influence.

Having disposed of the asphaltic features of the mixture, the equally and possibly more important mixture factor is the sand, which comprises, approximately, 90 per cent. of the asphalt covering. To bring forcibly to mind the sand factor, I need but cite you to a discussion at the recent International Congress of Engineers, of the relative value of stones for macadam. One of the speakers, referring to sandstones, said that it should not be forgotten that there are extreme differences in the quality of sandstones. No one who has observed sandstone from various quarries and localities can fail to be impressed with the truth of this statement. Yet few stop to think that sandstones are composed of grains of various grades of sand. That being the case, is it not evident that an asphalt paved surface, an artificial sandstone monolith covering, is as apt to vary in its qualities, owing to different gradings of sand, as the natural sandstone itself? Extended observations on this subject have clearly shown that to produce the best wearing mixtures, sand of certain various graded grains gives better results than other sands.

The problem of how to determine and secure the sand that will grade best, and at the same time prove the toughest and most adaptable to resist wear like the natural sandstone of the best quality, is still only partially solved. Independent of the sand and asphalt, I have already outlined the need of a suitable filler. My information as to the use of Portland cement for this purpose in place of the natural dust of carbonate of lime was obtained from an interview with Mr. Clifford Richardson, who is, doubtless, the greatest living expert on asphalt pavements, taken in their entirety. His work, entitled "The Modern Asphalt Pavement," which has since appeared, refers to the good results of a Portland cement filler, but disclaims an understanding of the reason why.

Having now outlined the general problems and factors of asphalt paving construction, I will briefly outline the factors of maintenance and cost.

The history of municipal growth has shown it impossible to avoid constant cutting up and otherwise disturbing the paved surfaces of urban streets. Water works construction, sewer construction, gas construction, and telegraph, electric light, telephone and other conduits of every kind are brought into demand with each new discovery and each new construction, and the problem of finding a pavement that is permanent is as unsolvable as the "squaring of the circle."

The only feature of permanency existing in public works is that of permanency of repairs. In connection with asphalts, as well as other pavements, the economic lines are along those of prompt attention to the repairs before the cuts are enlarged by traffic. Twenty years of close observation of municipal conditions leads me to the conclusion that every city should have a plant and an organized corps of skilled men to attend to the maintenance and repair of its paved streets. Once equipped with the best of modern appliances, streets can be kept in a condition of continuous repairs at the minimum cost. To do this the construction and engineering departments must be divorced from partisan politics and placed under a permanent system of civil service.

In the short period of asphalt repairs, conducted under the writer's supervision this year, sufficient figures have been obtained to warrant the belief that at least 25 per cent. can be saved to the municipality by ownership of its own repair plant, and certainly 50 per cent. more comfort can be gained thereby, and still a greater per cent. of damage to vehicles avoided, not to speak of persons hurt. The same experience briefly developed at Omaha is reported by Mr. Proctor, the expert in charge of the Detroit plant, which has been in operation over one year.

We now come to the factors governing the cost of asphalt pavements.

The approximate relative cost of the various elements in an asphalt pavement, barring legal or other unnecessary avoidable expense, may be considered distributed about as follows:

Excavation and preparing earth road surface..	7 per cent.
Concrete base	38 per cent.
Binder 1½ in. thick........................	14 per cent.
Asphalt topping, 1½ in. thick................	29 per cent.
Plant use	5 per cent.
Superintendence and miscellaneous..........	3 per cent.
Contingencies	4 per cent.
	100 per cent.

Independent of these percentages of cost, two important factors materially affect the cost of asphalt paving.

First—The legal provisions for the work.

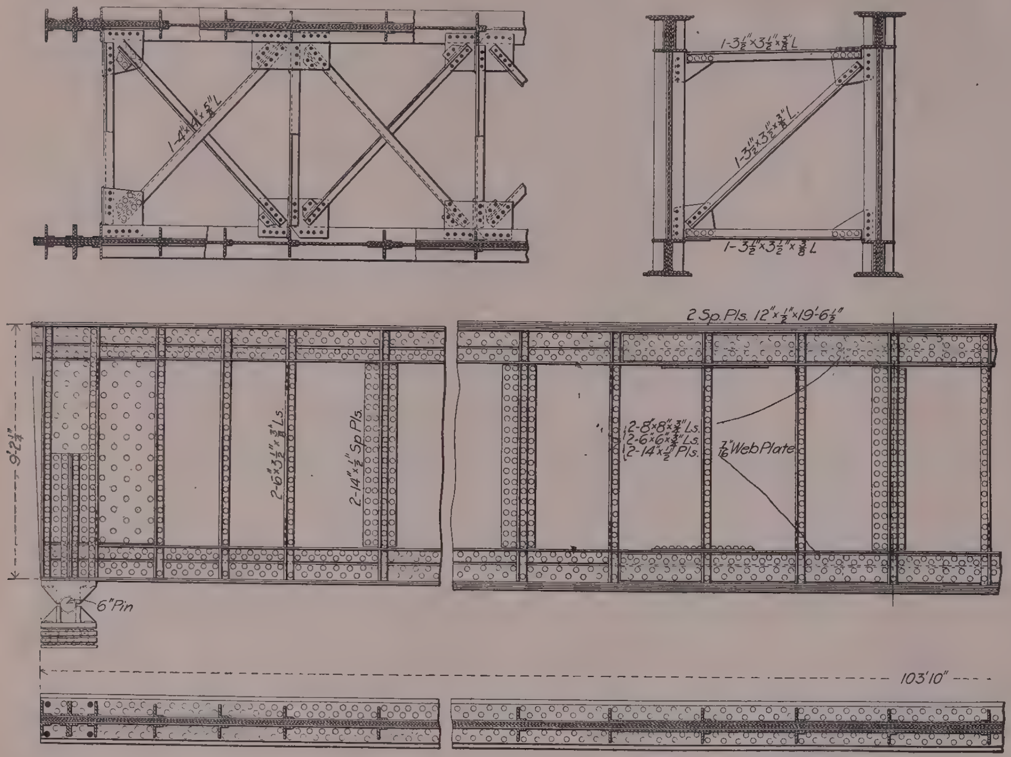
Second—The directness of all provisions in specifications.

With reference to the legal provisions, every contractor, to avoid uncertainty and risk in undertaking work, should be insured that every necessary step required by law to be taken should be clearly set out in the laws and ordinances and properly followed. Every step taken by the contractor through uncertainty as to these provisions is necessarily charged for to justify the risk. The cities of the country invariably pay dearly when their lawmakers, through incompetency or purposely, make ambiguous laws affecting public improvements.

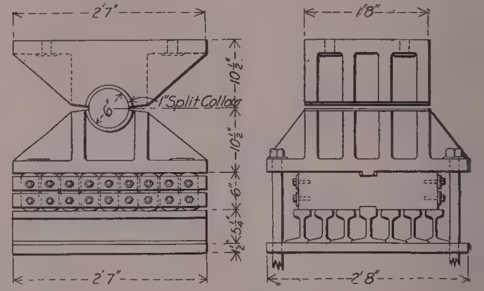
The second factor, viz., proper specifications, is equally as important as the first. If an engineer or board of public improvements make a two-sided specification whereby uncertainty exists as to the intent or future interpretation of any provision, the contractor feels exposed to the possibility of its operating against him by what is known as a "hold-up" process, and he makes provision in his bid accordingly. It is a very common thing to see provisions in asphalt specifications purposely, or through ignorance, so worded as to enable the municipal officials to exercise power in such manner as to make or break a contractor with seemingly good cause. Every specification to bring about the best results for the city, both as to good work and also economic prices, should designate unequivocally everything to be done and how it is to be done, and not, as is often worded, "as the engineer or board may determine." There is no excuse for half of the vague terms in ordinary specifications, and wherever they exist the municipality must ultimately pay for the faulty features. It is the business of the specifications to define every possible requisite directly, both as to kind, quality and extent of the materials required and how they shall be applied; and prices should be called for upon a specified basis for all extras that may possibly enter into the work. Every proposal should be based upon a designated list of materials as to quantity which should form the basis of determining the lowest bidder, so as to remove the possibility of fraud, or the suspicion that fraud may be practiced. Every contractor at the same time should understand that he will be required to perform what he agrees to do under his contract. With honest specifications only can the cities look for honest and economical work.

A last and not least important factor is the provision for payment. If a contractor must receive tax certificates and collect his pay from them, or some other bills payable, upon which there hangs an uncertainty as to time of payment, he will invariably charge enough more for the cost of such risk and collection. The best and economic method is to provide for cash payment by the city, which is better able to raise money at low rates of bonded issue, or by some equally good method. Such provision will be a material factor in reducing cost of paving.

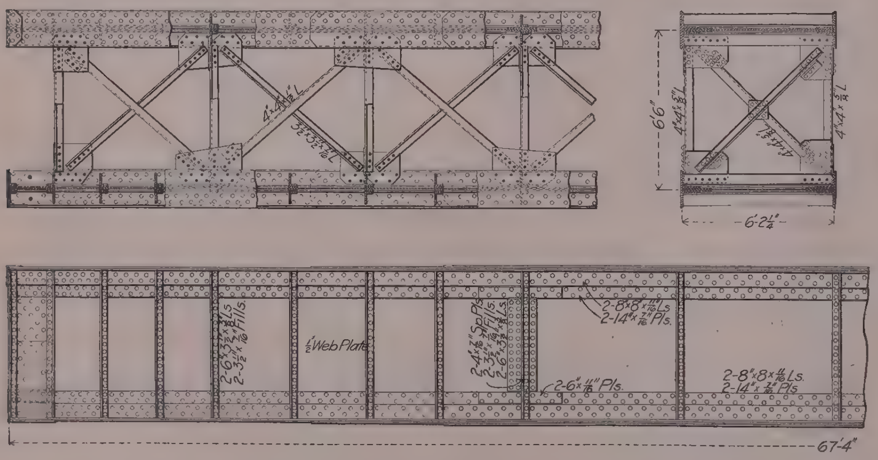
In concluding, by way of supplying an omission under the head of maintenance, I deem it proper to add a suggestion relative to the durability of an asphalt pavement. It has been shown that water deteriorates all asphalts if continuously allowed to stand upon them. Asphalt pavements are practically impervious to water—the slightest depressions of even one-twentieth of an inch will hold moisture which to the eye makes the pavement frequently appear as full of holes. The water upon asphalt streets will rapidly evaporate if simply the result of a rain or a periodical flushing, but the drenching of asphalt paved surfaces by continued hourly sprinkling leaves the surface constantly moist, and as a result subject to rapid wear from traffic erosion. Asphalt streets should be swept and not sprinkled, if they are to be economically used.



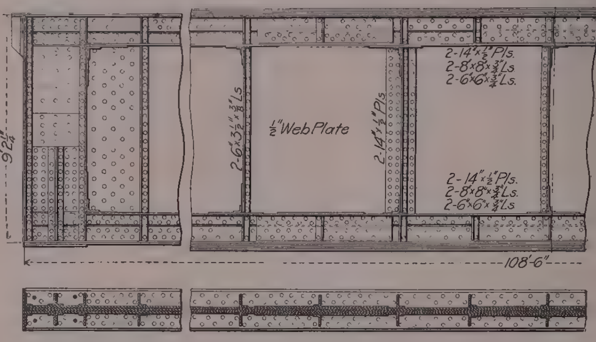
Bridge No. 31 Over Pawcatuck River.



Expansion Bearing for Bridge 106.



Bridge No. 40 Over Hunt's River



Bridge No. 106 Over Housatonic River.

A Three-Wire Railway is now running between Nuremberg and Fuerth. The road is divided into two sections, and arrangements are provided for transferring parts of one section to the other in order to obtain better balance. In the section nearer the station the overhead wire is positive, in the more distant section negative. The out-of-balance current is stated to be very small, and no rail feeders are provided.

Some Deck Plate Girder Bridges on the New York, New Haven & Hartford R. R.

The general specification for railroad bridges on the New York, New Haven & Hartford R. R. provides for a distance of 13 ft. between centers of parallel tracks. Girders are used in preference to trusses up to lengths as long as can be shipped from the shops or can be safely handled. The length is governed by the economical height, which cannot exceed about 10 ft., as the minimum clearance above rail base is 14 ft. 2 in. The longest spans on the road are about 115 ft. Deck plate girders are used wherever the conditions will permit, and are made with two girders for each track. All of the new spans on the main line are for four tracks, but double and single-track spans are used on some of the branches. A large amount of renewals have been made recently, and about 40,000 tons of plate girder bridges have been erected within the last four years.

The standard construction of moderate length double-track deck spans is illustrated by bridge No. 40 of the Shore Line Division, over Hunt's River, near Davisville, R. I., with a single clear span of 63 ft. 2 in. The four girders are about 67 ft. 5 in. long and 76 in. deep over all, and are spaced 3 ft. 3 in. and 9 ft. 9 in. from the center line. The pair of girders under each track forms a wholly independent span, divided into ten panels by vertical transverse sway frames. The end sway frames are set about 2 ft. from the ends of the girders at the second stiffener angles, and are X-braced with 4x4-in. angles having both flanges connected. The intermediate sway frames have single diagonals made of 3½x3½-in. angles. Horizontal connection plates engage both the horizontal transverse angles of the sway brace frames and the top and bottom flange angles of the girders, and receive the field-riveted connections to the zig-zag lateral angles. The lower laterals are made of 3½x3½-in. angles of varying thickness throughout, but the upper laterals are made of 3½x3½-in. angles in the center and of 4x4-in. angles in the end panels. The lateral connection plates are uniformly 7/16 in. thick and are notched to clear the vertical web-stiffener angles.

Each girder has a web ½ in. thick throughout, made with two splices, the latter being designed to provide for shear and for that proportion of the bending movement which is assumed to be resisted by the web. The top and bottom flanges are alike, each consisting of two 8x8x11/16-in. angles, two 14 x 7/16-in. vertical side plates, and three 18 x 9/16-in. cover plates, the first of which is full length. None of the flange pieces are spliced. The web is divided into panels from 1 ft. 6 in. to 6 ft. 3¾ in. in length by pairs of 6x3½-in. vertical stiffener angles and fillers with their upper ends fitted to bear against the flange angles. A 7/16-in. sole plate is riveted to the bottom flange at each end of the girder, and at the expansion end has two slotted holes 3 in. long for anchor bolts. In the short panels over these bearings the girder webs are reinforced by two 11/16-in. plates 22 in. wide, riveted on each side. The sole plates are planed and at both ends are seated on planed 13/16-in. bed plates, with a guide strip riveted to each longitudinal edge. The ends of the girders have an 18x⅜-in. vertical cover plate, and short bent plates protect the upper corners. The complete span weighs about 78 tons.

Bridge No. 31, over the Pawcatuck River, on the Stonington branch of the Shore Line Division, at Shannock, R. I., differs from bridge No. 40 chiefly in dimensions, in the details of the flanges and in the end bearings. The length over all is 103 ft. 10 in., and the clear span is 98 ft. 9⅝ in. The center line of each track is slightly curved and intersects the center line of the span in two places about half way from the end to the center, so that the middle part of the bridge axis is a chord of an arc of ¾-in. versed sine.

The girder on the inner side of the curve has a web 108 in. deep; that on the outer side is 110 in. deep to allow for the elevation of the rail. The web is 7/16 in. thick in the middle and ½ in. thick in the end panels, and its splices do not provide for bending moment stresses. The H-shaped flanges are alike top and bottom, and are made of a pair of 8x8x¾-in. full-length angles, a pair of 6x6x¾-in. spliced angles, and a pair of 14x½-in. spliced vertical side plates, all splices being arranged near the center of the girder to make staggered joints. There are also in each flange four 21x⅝-in. cover plates, one of them full length. The web is reinforced by two ½-in. cover plates about 6 ft. wide at each end, over and extending a little beyond the hinge bearings.

Each hinge is made with a triple-web, cast-steel shoe and pedestal with half-hole bearings on a 6-in. pin. The three longitudinal webs are united by a center transverse web 10 in. thick, which affords a continuous bearing for the pin and locks it in position by means of a recess in the center, engaging a 2x1-in. split collar fitting a groove in the pin and screwed to it. The shoe is fastened to the lower flange of the girder by four 1½-in. turned bolts, and there are four 2-in. anchor bolts securing the pedestal to the masonry. At the expansion end the pedestal is seated on a nest of seven 6-in. segmental rollers grooved to engage a rib in the center of a rolled steel bed-plate 2 in. thick. At the fixed end the masonry is built higher than at the expansion end, and the pedestal is seated directly on it. The complete span weighs 235 tons.

The four-track span No. 20 of bridge No. 106 of the New York Division, crossing the Housatonic River at Naugatuck Junction, Conn., has four pairs of girders 108 ft. 6 in. long. The web plates are 110 in. deep and from ½ to ⅝ in. thick, reinforced in the end panels to a total thickness of 3⅛ in. directly over the bearings. The maximum flange section is made with two 8x8x¾-in. angles, two 6x6x¾-in. angles, two 14x½-in. web plates, and one 20x⅝-in. cover plate, all full length, and four 20x⅝-in., part-length cover plates. The flange splices are made in the panels next the center of the girder, as shown in the part elevation, and the horizontal legs of the flange angles are braced with short sections of vertical angles in line with the main web-stiffener angles and intermediate in the two panels on each side of the center of the girder. The bearings are similar to those of the shorter girders, except that the shoes and pedestals are somewhat larger, with four transverse webs, and the expansion rollers are seated on a rail bed. The whole span weighs 520 tons.

Both of the bridges are proportioned, according to the railroad company's standard specifications for 1901, for a live load on each track consisting of a train weighing 5,000 lb. per linear foot, preceded by two coupled locomotives each with a 45,000-lb. load on each of four axles 5 ft. apart and 28,000 lb. on each of four other axles 5 ft. apart. A static wind pressure of 30 lb. per square foot of all exposed surfaces and a moving pressure of 30 lb. per square foot is allowed on the train surface. The centrifugal force is assumed to be 4½ per cent., per degree of curvature, of the live load on all tracks. Horizontal longitudinal thrust is computed from the coefficient of friction, which is assumed to be 0.25 for the train sliding on the rails, 0.3 for planed steel surfaces, and 0.05 for steel rollers between planed steel surfaces.

Unit stresses are taken at 9,000 lb. in tension for plates and shapes. The web is not considered as transmitting any flange stress, and is proportioned to receive a maximum shear not greater than 7,500 lb., or not greater than $10,000 \div [1 + (d^2 \div 3,000\, t^2)]$, where d is the clear distance between vertical web stiffeners and t is the thickness of the web plate, both in inches. Rivets are proportioned for shearing and bearing stresses of 7,500 lb. and 15,000 lb., respectively. Expansion rollers are proportioned for a pressure not exceeding $900 \sqrt{d}$, where d is the diameter in inches. The plates used are required to have an ultimate strength of from 56,000 to 64,000 lb., an elastic limit of 55 per cent. of the ultimate, 25 per cent. elongation and 50 per cent. reduction. Rivet steel has an ultimate strength of 48,000 to 54,000 lb. The angles are required to open flat, while cold, without fracture, and those under ⅝ in. thick to be shut close with a hammer. All material is required to stand punching with 15/16-in. holes 1¼ in. apart, or 1¼ in. from the edge, and the holes to be drifted to a diameter of 1½ in. without cracking.

The bridges were designed and their construction is being directed by the engineering department of the New York, New Haven & Hartford R. R., Mr. C. M. Ingersoll, chief engineer, and Mr. W. H. Moore, engineer of bridges.

The Application of Gas Power to Electric Railway Service.

The possibility of using gas power in electric railway service is now well established by a number of such plants, but it is important in considering any such installation to bear in mind the characteristic demands of power for such work, and their difference from the demands of electric lighting. This point was well brought out in the opening portion of a paper read before the American Street Railway Association this week by Mr. J. R. Bibbins. He pointed out that a generating plant for railway service, especially for suburban and heavy duty work, must be unusually responsive to sudden power demands; to accomplish this the two sections of the plant must be peculiarly well fitted to operate together under normal load conditions. The plant should also be quick in starting, capable of standby for long periods without excessive loss of heat and, above all, should show high all day fuel economy. The adaptability of the gas engine to this service must be granted, and the discussion of gas power for railway service will hinge on other features of the plant.

The future of the gas engine in its general application depends largely upon the development of a producer gas system especially suited to the use of low grade bituminous coal. Anthracite producers have already reached a high state of perfection, are reasonable in price, simple to operate and are usually unencumbered with much auxiliary apparatus. They do not deteriorate rapidly, and generally show an efficiency considerably higher than the best steam boiler and furnace, viz., 75-80 per cent.

The ideal bituminous producer is yet to come, viz., one in which the volatiles are completely converted into fixed gases without serious loss and without complication of the operating system. There are a number of makes now on the market intended to be used with bituminous coal, but when the gas is to be used in engines they are attended with special, and often complex, cleaning apparatus for the removal of suspended impurities. The efficiency of bituminous systems is also generally lower than anthracite, not only owing to the fact that some of the valuable distillates are lost, but on account of the distillation of volatile matter requiring heat for its accomplishment. Present types sometimes exceed 70 per cent. efficiency, which rivals that of the best boiler plant.

Passing to some of the practical points, a producer, if provided with an automatic blast control, may be made almost instantly responsive to variations in demand for gas. This is shown by the success which the suction producer has attained in small sizes; and in this respect the steam boiler is quite outclassed, owing to the more direct effect of the blast in transferring the heat content of the coal to the working medium—gas. In one type of producer the steam blast and consequently the gases generated are controlled entirely by the pressure in the delivery gas main and in inverse proportion. Steam is generated at a rate proportional to the demand for gas without requiring extra boiler equipment or fuel. This largely increases the producer efficiency.

This producer is designed for use without a gas holder and has been succesful in this particular. The especially severe conditions of heavy railway work, however, prescribe storage capacity at some part of the system. Owing to the limitations of gas engine capacity, electric storage is evidently the most desirable, as it relieves the machinery of the wear and tear of fluctuating loads. There is ample precedent the world over for the use of a storage battery auxiliary in railway plants, and it should prove even more desirable in a gas power than in a steam power plant. In fact, gas storage is often to be desired in many plants where the gas demand varies greatly, simply as an insurance against poor gas, due to careless operation. This, however, simply relieves the gas generating equipment, while electric storage relieves the entire station.

Standby losses in a steam power plant are an important source of inefficiency and difficult to determine accurately. Mr. Dowson has made some comparative observations with eight steam plants and several producer plants, averaging about 250 h.p. capacity. The actual standby fuel consumption of the boilers was 35 to 180 lb. per hour, and of the producers 2 to 4 lb. per hour. Running losses are evidently also much less. We may pipe gas for great distances with small loss. Not so with highly superheated steam under high pressure. When a gas engine plant is shut down the losses practically cease; with steam, condensation is uninterrupted.

The comparative cost of labor and supplies for gas and steam plants is difficult to state in definite terms. With the same character of labor there should be no appreciable difference between the two. A very important point is the personal attitude which engineers take toward gas machinery. The best plant will quickly depreciate in the hands of operators who have taken a personal dislike to the innovation. In many plants the old steam engineers and oilers have been retained and placed in charge of gas equipment, after a thorough coaching by competent erecting engineers. After this is done properly the invariable result is highly successful operation.

In well-regulated plants, equipped with a continuous return system, the oil consumption should not much exceed, if any, that of a steam plant. Two 500-kw. gas plants at Franklin and Bradford, Pa. (each consisting of five Westinghouse vertical enclosed type engine units), average through the year less than half a gallon per unit day. At another station, near Warren, Pa., using three vertical open type engines of 275 h.p. capacity each, the oil consumption averages under 0.9 gal. per unit day.

Maintenance expense is frequently thought to be excessive in a gas station. When this is so we may look for faulty operation or design of the plant. Recent data from the station at Bradford, Pa., shows what may be accomplished when the equipment is properly operated. The plant is in its seventh year of service; yet the average cost of repairs on the engines for the last two years was $92.70 per year, or 11.6 cents per horsepower year. After six years' service, averaging 18 hours per day, it is found necessary to inspect the engines only once in twelve months. This was formerly done in three months and later in six months. At each inspection a set of piston rings is replaced by new ones, whether worn out or not. Up to the present time no extensive repairs have been made on any of the engines, except a voluntary change, on the builders' part, from dry to water cooled exhaust valves. The present exhaust valves average one year's working without regrinding, and even then are not in bad condition. Some valves have run 15 months. Admission valves require no attention. Igniters average about nine months without repointing. By reversing the current each day electro deposition is entirely avoided, so that the points wear evenly.

A notable run was recently reported by the superintendent of a gas compressing station in central Ohio, where a 650-h.p. Westinghouse vertical engine is at work. This engine was under maximum gas load continuously night and day for 40 days, without a misfire or mishap of any kind, and without incurring extra expense for repairs.

Much of the prejudice against gas power is due to exaggerated statements regarding the comparative capital cost of steam and gas equipments. In some instances it has been stated that for the same character of equipment the gas plant costs double. This is not the case; in fact, in larger plants the two may be brought nearly to a parity, and the higher economy of the former will soon wipe out the difference in actual cost.

The engineer's report on the accepted tenders for an 8,000-kw. plant shows a total excess cost of gas plant of 7.4 per cent. actual, or 14 per cent. with certain extras charged to the gas plant for additional ground and building requirements; yet the annual saving in operation is estimated sufficient to annul the excess cost of gas plant in less than two years. Capitalized at 5 per cent. interest this annual saving represents a capital of $1,485,000, or considerably more than the original cost of the entire gas power station. In other words, the gas plant might have cost twice the actual amount and still realize a definite annual saving over steam power.

A brief perspective, as it were, of the work that has already been accomplished in the gas power field was given by Mr. Bibbins in the conclusion of his paper. The application to railway service has in this country been limited; yet abroad there are many evidences of successful working. A prominent European engineer reported in 1903: "Nineteen stations on tramway work, totaling 6,000 h.p. capacity. These include Barcelona, Tunis, Lausanne, St. Gallen, Poictiers, Orleans and Zurich, from 400 to 600 h.p., each working on either producer or town gas." As a result of the excellent experience with the Walthamstow electricity station, 650 h.p. has been added to the plant for operating the new tramway system recently constructed. At Buenos Ayres, South America, two plants, aggregating 2,240 h.p., are at work for the Buenos Ayres Great Western and Great Southern Railways. Both use Mond gas. But, eclipsing in interest probably all former gas power railway undertakings is that of the Warren and Jamestown Railway system now under construction. This plant will practically inaugurate the use of the heavy duty type engine, in connection with single phase railway systems in America. The new engine equipment consists of two 500-h.p. Westinghouse double acting engines of the horizontal tandem type, each direct connected to a 260-kw., alternating-current engine type generator. These engines are both of the single crank type, but with the tandem arrangement, a power stroke is developed at each half revolution, as in the double acting steam engine. The gas units will operate in parallel on the electrical end, without the necessity of synchronizing the cranks. Owing to the absence of battery and the small number of cars, the plant will be subjected to the most severe test possible. It is estimated that one generating unit will take care of the present maximum demand with two cars starting and two running. Natural gas fuel is entirely used in this territory, and at the present price and heat value will correspond with producer gas delivered at a cost of about two cents per thousand cubic feet. The economy in operating with natural gas is striking. In the old gas plant it is estimated that the cost of power averages 0.75 cent per kilowatt hour, including all items chargeable to operation, except repairs on building and battery; the corresponding gas consumption being 20 cubic feet per kilowatt hour.

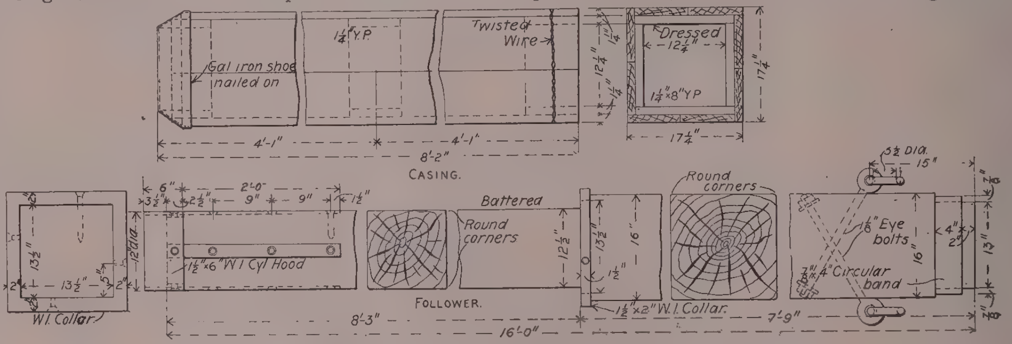
Among gas power stations in American and British territory we find a large number up to 2,600-h.p. capacity operating on producer, natural and oil gas, and many with the alternating-current system with generators running in parallel. In fact, parallel operation by gas engines on a large scale was first accomplished in this country at East Pittsburg, with three cylinder engines of the vertical single acting type. In view of the success with this type of engine, it is evident that the tandem and twin-tandem double acting type should be even more suitable. In Great Britain 20 central stations, from 40 to 2,000 kw. in capacity, are in operation, mostly with producer gas.

In the field of electric lighting much has been accomplished. Outside of the Walthamstow station, already mentioned, an interesting plant is the 1,150 h.p. station of the Rockland Electric Co., at Hillburn, N. Y., equipped with Westinghouse horizontal double acting engines, operating on Loomis-Pettibone producer gas. As in several other industrial plants using this type of producer, most of the water gas generated is used for furnace heating, while the "air" or "blow" gas, too lean for other purposes, is used entirely in the engine plant. In many respects this system is unique in that it makes possible the commercial use of otherwise expensive water gas, while the cheap "air" gas is rendered useful for generating power.

The operation of close to 100 plants, from 200 to 2,600 h.p. in capacity, would seem to indicate that some measure of success has been attained. That one-half of the aggregate capacity operates on natural gas and but one-third on producer gas simply emphasizes the value of this country's natural resources, rather than reflects upon the producer gas system, especially when one considers the comparatively short time that producer gas has been seriously taken up. About 10 per cent. of the larger plants, above 200 h.p., operate city and suburban railway systems. The remainder are devoted to many classes of service, such as light and power for city and suburban territory, power for the electrical driving of industrial works, power for operating railroad terminals, gas compressing stations, water pumping plants and high service fire systems. A notable example of the latter is the 2,200-h.p. station in Race St., Philadelphia. Most of the prominent types of producers are represented, including the Mond, Loomis-Pettibone, Dowson, Taylor and the more recent Westinghouse system. A few small plants are working on suction gas. This indicates that successful operation is not confined to any particular type of producer.

A New Method of Constructing Concrete and Pile Footings.

In the construction of the new platform shelters for the Hoboken terminal of the Delaware, Lackawanna & Western R. R., a very ingenious method of putting in the foundations has been devised by Mr. Lincoln Bush, chief engineer of the company. The design of these platforms was illustrated in this journal on June 24 of this year. There will be fourteen tracks entering the terminal, and they will be arranged in pairs, with a concrete platform 20 ft. wide between each pair. Down the center of each platform there will be a single row of cast-iron columns spaced 27 ft. apart and carrying the solid web roof girders.



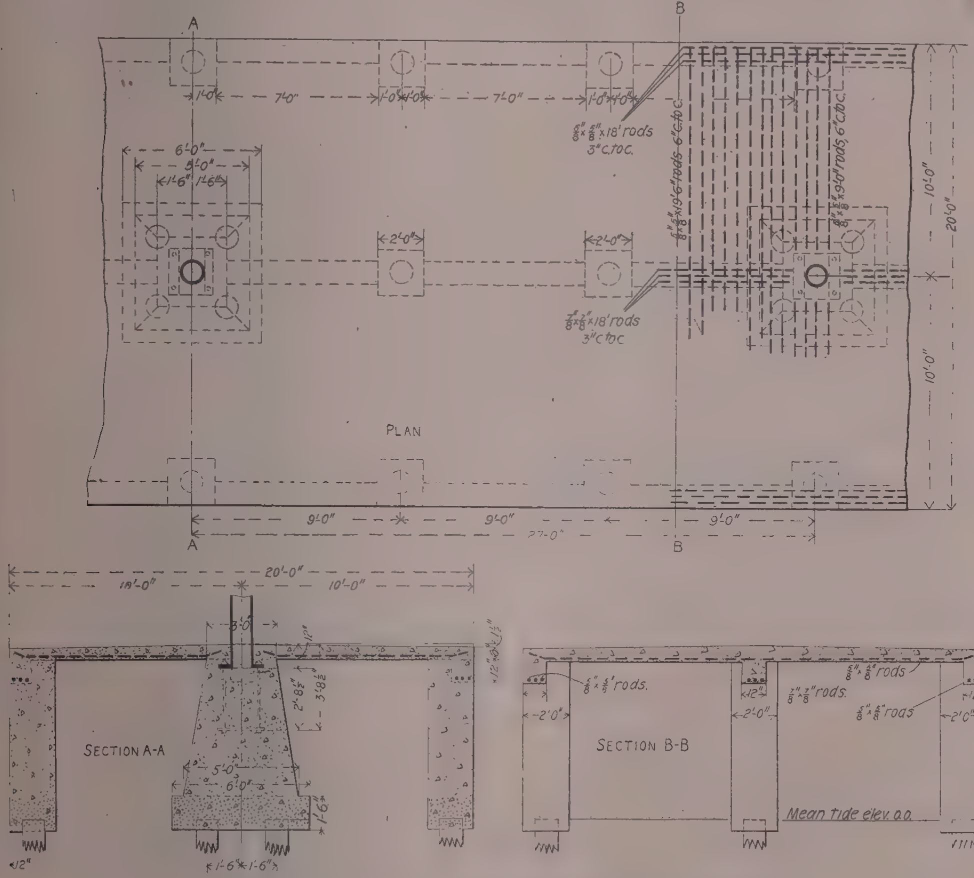
Concrete Mold and Follower for Driving Piles, Hoboken Terminal.

The general design of these platform shelters is decidedly novel and was adopted for several reasons, one of which was the poor capacity of the site of terminal to carry heavy concentrated loads. The ground is entirely reclaimed, having been made by filling in an old bay, and a continuous, uniform settlement has been taking place back of the bulkhead line for a number of years. Accordingly the footings and the platforms themselves have been designed to avoid any difficulty from this source.

Three rows of piles are driven under each platform on the lines shown in the accompanying diagrams, and four piles are driven under the footing of each cast-iron column. These rows are 10 ft. apart laterally, and the piles in each row are 9 ft. apart. The tops of the piles are at mean tide level about 7 ft. below the platform surface, and are bedded 6 in. deep in the base of the square concrete piers which support the platform. There are 1,800 of these small piers under the terminal shed, and their construction by digging a pit, driving a pile in it, and then cutting off the pile by hand would be tedious. As the work is being done on a site over which a great number of suburban passengers must pass twice a day, the handling of the material from the pits in such cramped quarters would be troublesome, while the use of the forms necessary in that case would also present certain complications from the same cause. To overcome these difficulties Mr. Bush has devised a method of driving the pile and sinking the form for the pier in a single operation. This unique system of working is giving entire satisfaction.

The pile is driven by a follower over which is the form for the pier. After the pile is driven in the usual way, by a revolving-table pile driver car running on the tracks of the terminal, the follower is lifted out, leaving the form in place ready to receive the concrete. The concrete is made in a mixer mounted on a flatcar. This car is made up in the center of a short train of material cars, which is hauled along the track so as to discharge the concrete close to the place where it is needed. The concrete is used very wet, and that for the platform proper is discharged from the mixer through a light iron chute directly into place. This method of working is expeditious and presents the minimum obstruction to traffic.

It will be seen from the accompanying drawings that the follower has a shoulder which drives the form with the pile, the bottom of the box being directly on top of the pile head at the mean tide elevation. There is a metal hood on the end of the follower which fits directly over the head of the pile and holds all the parts in their proper position. The follower has a slight taper. The skin friction between the earth and the form is greater than that between the three nailing strips inside the form and the follower, so that no trouble has been experienced in pulling out the follower without distorting the shape of the form.



Part Plan and Cross-Sections of Platform, Hoboken Terminal.

A COAL TESTING PLANT of large size has been built by the city of Birmingham, England, in order to determine the quantity and quality of gas that can be made from samples of coal, the yield of ammoniacal liquor and tar, the impurities in the crude and purified gas and other properties necessary in judging the quality of the coal. The plant consists of a retort house, condensers, exhauster house, washer, purifier and holder, and is capable of producing 250,000 cu. ft. of gas daily under conditions that enable all stages of the process to be observed carefully.

Book Notes.

Some years ago the Mechanical Engineering Department of the University of Illinois published a pamphlet entitled "An Extension of the Dewey Decimal Classification Applied to Mechanical and Railway Engineering." It was designed to facilitate the indexing of articles in technical journals and has received favorable notice from many sources. Prof. L. P. Breckenridge, head of the department, has published a fourth edition of this work, a copy of which will be sent free on application to him at Urbana.

The Home Insurance Co. of New York has issued under the title of "Comparative Values of the Details in Buildings of Fire-Resisting Design" a very interesting handbook for the use of special agents and inspectors. It is a statement of what this company considers good construction from a fire-resisting standpoint. Some of the opinions are contrary to those held by engineers, few of whom will agree, for instance, with the following statement: "Cast-iron is to be preferred to steel [for columns], especially for basements or other damp locations where rust is liable to form, as the greater thickness of cast-iron permits a relatively greater degree of corrosion before the danger point is reached." Reinforced concrete buildings are to have their highest grading when it is certain they are absolutely well constructed. The information in the book will be particularly useful to those who have occasion to look up the reasons for the insurance rating of any building, as the rules for grading are clearly and concisely stated.

REFUSE DISPOSAL AND POWER PRODUCTION. By W. Francis Goodrich. London, Archibald Constable & Co.; cloth, 8vo., 16s.

Four years ago the author of this book wrote a volume on the same subject and it is accordingly somewhat surprising to receive this work for review. It is, however, entirely unlike the earlier book. That was general in its character, while this is specific and is essentially a record of what is being done by British refuse crematories. This does not mean that the contents lack a discussion of the broad problems of refuse collection and disposal, for 175 pages are devoted to this subject. In fact the author's evident interest in it has led him into giving space to minor details and opinions which might be omitted without any injury. The value of the book lies mainly in the three chapters describing what is being accomplished in refuse disposal in the United Kingdom.

Although the heat furnished by these plants is employed for steam raising purposes in very many cases, Mr. Goodrich is emphatic concerning the importance of never forgetting that the disposal of the refuse in a sanitary manner is the primary purpose of the destructors, and not power production. The latter is important, but only secondary, as bearing on the cost of refuse disposal. The author describes the construction of different types of British furnaces, gives general figures of the cost of running them, and explains the uses for the clinker from them. The detailed results obtained in the individual plants furnish many valuable data, although it is surprising to notice that really complete tests and service records of these combined destructor and power plants are very few. The information is far more definite and valuable than that to be obtained in America, however, and the book is correspondingly useful to American engineers.

THE MECHANICAL HANDLING OF MATERIALS. By G. F. Zimmer. London, Crosby, Lockwood & Son; cloth, quarto, 521 pp., $10.

The author of this work has gathered from technical papers and by personal inspection an enormous amount of information concerning British and European plants for handling various materials. This information is nearly equaled by the illustrations which accompany it. Elevators, conveyors, rope haulage, cableways, buckets, dump cars, freight-handling apparatus, tipples, weighing machines and cantilever cranes form the principal classes of equipment described. The text explains the purposes and uses of the equipment, but gives very little information concerning its first cost and the expense of operation. This is not surprising because such data are generally considered business secrets by those who possess them, and there are a good many people having these plants who care very little about their cost, provided they accomplish their purpose. Unfortunately the information in the book concerning the working capacity of much of the equipment is not sufficiently definite to be of direct value.

The usefulness of the book lies in the fact that it is the first attempt to describe apparatus for handling materials mechanically. This particular branch of engineering is rapidly developing, and deserves to be reviewed very carefully. As Mr. Zimmer's material is drawn mostly from sources which are not available to American readers, it has a decided value. As a practical introduction to the methods and plant employed in the United States it is lacking in many respects. In fact it may be seriously questioned whether the field is not too great to be covered thoroughly and practically by a single author. For example there are some systems of good conveying apparatus fully described in reliable trade publications and in technical publications, while others which are giving good satisfaction have been mentioned rarely and their operating costs and capacities are known to but few people. A full discussion of conveyors alone requires a breadth of information that very few people possess, and they are not saying much for publication.

Letters to the Editor.

Bedding Heavy Bridge Pedestals.

Sir: The article on the "Progress of the Quebec Bridge," in your issue of Sept. 16th describes the bedding of the pedestals on two layers of No. 1 cotton duck, each layer of canvas being painted with two thick coats of pure linseed oil and red lead, allowed to set, but not harden, before the pedestals are placed upon it, the top surface of the canvas being given a final coat of paint and enough paint used to exude around the edges of the base plate and seal it with the masonry. The reason given for this construction is that the tests made at Watertown Arsenal with a lead filler between the masonry and pedestal showed that the flow of the lead under pressure produces a bursting force, thus reducing the resisting strength of the stone to pressure.

The writer has used the lead filler, but always between metal plates, and believes that it performs an important duty that cannot be secured with the canvas filler. The trueness of the planes of the pedestal and masonry and their exact parallelism after the structure is erected, cannot be confidently expected, and means should be employed whereby pressure over the joint will be equalized. A filler like lead that flows under pressure can accomplish the desired end, and if the masonry is protected from the effects of the flow by a steel plate set in cement, it would seem to be a desirable construction.

New York, Sept. 20. Geo. H. Pegram.

Sir: In the article in last week's issue describing the bridge now being built over the St. Lawrence River, near Quebec, I notice a statement that tests recently made at Watertown Arsenal show that sheet lead is an improper filler between bridge bearings and masonry, on account of the lead flowing into the interstices of the masonry and injuring it. Can you not give a detailed account of the tests referred to, so that those of us who have been using sheet lead may have good grounds for changing our practice?

It has been my practice to require the lower surfaces of all cast or wrought iron or steel bridge bolsters, or bed plates to be roughly planed, and to have the bridge seats under these bearings carefully "spotted" to correct level and true surface, and as a further precaution, and to make sure that the bearings would be the best possible, I have been using sheet lead between the bolsters and the masonry. That lead will flow to such an extent as to injure the stone or concrete in a bridge seat at such low pressure as is permissible in first-class specifications, is news to me.

Yours truly, C. F. Loweth.

Complicated Mill Building Construction.

Sir: Referring to Dr. Myron S. Falk's solution of the problem of the mill building column, in one of your recent issues, it would appear that there is an opportunity for a difference of opinion on several points overlooked by his critics. It is stated that the bending moment in the column due to the swing crane is $Wl \div 8$. Should this not be rather $Pl \div 4$, since the load is a concentrated one and not uniformly distributed? Furthermore, is not his value for the moment of inertia extremely approximate? The moment of inertia of a circular column as given by Church's "Mechanics," on page 96, is $\frac{1}{4}\pi(r_1^4 - r_2^4)$, which gives us 395 biquadratic inches instead of 207. With these corrections we obtain a stress in the outer fibre of 19,400 lb. per sq. in. instead of 28,300 lb.

Yours truly, L. M. Sanford.
Wilkinsburg, Sept. 19.

Diagrams for Reinforced Concrete Beams.

Sir: The accompanying diagrams were prepared for figuring reinforced concrete beams. The first was made to show the relative conditions and effects due to the various factors which enter into the calculations as worked out, using the "Prussian" formula published in The Engineering Record of July 2, 1904. As there are so many factors entering into the calculation of even a rectangular beam the second diagram shows only values for a beam 12 in. wide, but by a simple computation other widths may be determined after the value for one 12 in. wide is found.

The first diagram was purposely made to cover a wide range of conditions and is chiefly useful in determining the position of the neutral axis after the percentage of steel has been assumed and the desired stresses or moduli determined upon. It shows that as the ratio between the stresses increases with a given percentage of steel the ratio in the moduli also increases, but in a different proportion, using the same percentage of steel. At the same time the position of the neutral axis is lowered.

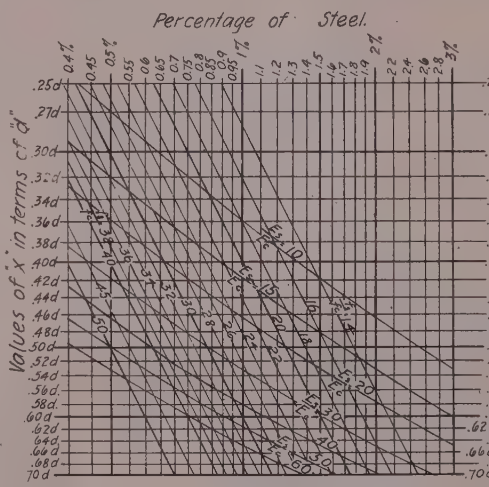


Diagram for Finding Neutral Axis.

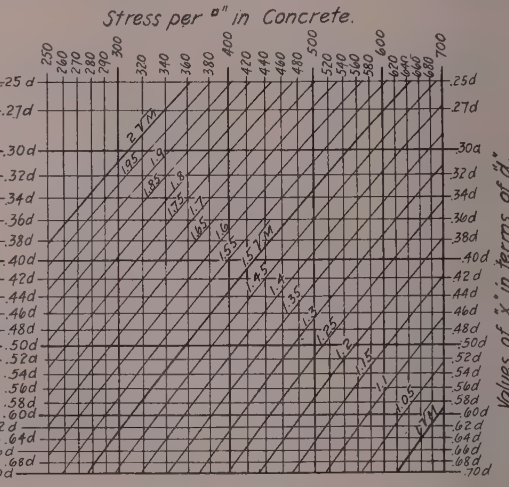


Diagram Giving Depth of Beam.

One way to use the diagram is to assume the ratio of the stresses and the ratio of the moduli. This determines the percentage of steel and the position of the neutral axis. Thus, if 500 lb. per square inch are assumed for the concrete and 16,000 lb. per square inch in the steel, the ratio is 1 to 32; and assume $E_s/E_c = 15$. Then the percentage of steel is 0.5, and the position of the neutral axis is $0.32\,d$, measured from the top of the beam.

The second diagram is to be used in conjunction with the first and is intended for rectangular beams 12 in. wide but can be used for other widths by making proper allowances. In the above example, by following along the line marked $0.32\,d$ to the intersection with the vertical line marked 500, the depth of the beam is found to be $1.52\sqrt{M}$ where M is the moment in inch tons. Thus, if the moment is 100 inch tons the depth would be $1.52\sqrt{M}$ or 15.2 in. For a beam 8 in. wide the depth is twelve-eighths of that for a width of 12 in.

If a moment of 190 inch tons is required for a beam 12 in. wide with a given depth of, say, 20 in. the method of procedure is as follows: The variable is $d \div \sqrt{M}$, or $20 \div \sqrt{190} =$ say 1.45. If the stress desired to be used in the concrete is 500 lb., find the intersection of line $1.45\ \sqrt{M}$ with stress line 500; and then follow across the diagrams to the intersection of whichever line for ratio of stresses is wanted. If a stress of 20,000 lb. is to be used in the steel then follow to the line giving $20{,}000 \div 500 = 40$. This shows the percentage of steel to be 0.44 and the ratio E_s/E_c to be 25. If this ratio is not the one desired, either a new breadth or depth will have to be assumed or some other factor changed. Thus, if a ratio of $E_s/E_c = 20$ be allowed and the same ratio in the stresses used, then the percentage of steel would be about 0.41, and the neutral axis found to be further up in the beam. Following along the neutral axis line from this last intersection read the depth $1.51\ \sqrt{M} = 1.51\ \sqrt{190} =$ 20.8 in. for a width of 12 in. If the depth of 20 in. be maintained the required breadth will be practically $20.8^2 \times 12 \div 20^2 =$ say 13 in.

Very respectfully, J. T. Ninesteel.
Philadelphia, Sept. 17.

A New Pile Formula Desired.

Sir: In considering the subject of foundations, after searching through many engineering treatises, I have been unable to discover a formula which could be used to find the sustaining power of piles. The formulæ that have been deduced for pile foundations are dependent upon the weight and type of hammer employed, the fall of the hammer and the final penetration into the soil. I would like to inquire if any of the readers of the Record can shed any light upon this subject. At the present time there seems to be a considerable lack of information on the matter, and yet, as every engineer knows, there are any quantity of cases of pile foundations in all kinds of soil. If some engineer would spend the time and patience to gather together the numerous practical data which exist to-day, systematize them, and evolve an empirical formula, which would give the sustaining power of piles, with factors of safety for the different kinds of material penetrated, he would contribute to the profession something which would be of the very highest value and bound to be appreciated by every engineer.

Yours truly, G. W. Ellis.
Albany, Sept. 21.

Tests of the Truscon Bar have recently been made at the Watertown arsenal to determine its resistance to pulling forces when bedded in concrete. The bar is made in eight sizes from ½ to 1½ in. in diameter by the Trussed Concrete Steel Co. and has washers along its length which are held in place by shoulders on the bar. Seven of these bars were tested by bedding them in blocks of 1:2:4 Portland cement concrete and then pulling them in the testing machine. In every case but one the bar broke without any disturbance at its end within the concrete. The outer ends drew away in part from the concrete, owing to the elongation of the metal after the load exceeded the elastic limit and caused considerable stretch. In one case the bar was not fractured, but the concrete was cracked from one end to the other.

CURRENT NEWS SUPPLEMENT

SEPTEMBER 30, 1905.

DIRECTORY OF NATIONAL TECHNICAL AND TRADE SOCIETIES.

American Society of Civil Engineers. Secretary, Chas. Warren Hunt, 220 West 57th St., New York. Next meeting, Oct. 6, paper on sewer flushing.

American Society of Mechanical Engineers. Secretary, F. R. Hutton, 12 West 31st St., New York.

American Institute of Electrical Engineers. Secretary, Ralph W. Pope, 95 Liberty St., New York.

National Fire Protection Association. Secretary, W. H. Merrill, Jr., Chicago.

American Institute of Mining Engineers. Secretary, R. W. Raymond, 99 John St., New York.

American Institute of Architects. Secretary, Glenn Brown, Washington, D. C.

Association of Engineering Societies. Secretary, Frederick Brooks, 31 Milk Street, Boston, Mass.

American Society of Heating and Ventilating Engineers. Secretary, W. M. Mackay, 235 Water St., New York.

Canadian Society of Civil Engineers. Secretary, Clement H. McLeod, 877 Dorchester St., Montreal.

American Public Health Association. Secretary, Dr. C. O. Probst, Columbus, O.

Society for the Promotion of Engineering Education. Secretary, Prof. M. S. Ketchum, University of Colorado, Boulder, Colo.

American Society for Testing Materials. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

American Society of Municipal Improvements. Secretary, George W. Tillson, Room 12, Municipal Building, Brooklyn, N. Y.

Association of Railway Superintendents of Bridges and Buildings. Secretary, S. F. Paterson, Concord, N. H.

American Railway Engineering and Maintenance of Way Association.. Secretary, L. C. Fritch, 1562 Monadnock Block, Chicago.

American Water-Works Association.. Secretary, J. M. Diven, Charleston, S. C.

American Foundrymen's Association. Secretary, Richard Moldenke, P. O. Box 432, New York.

Engine Builders' Association of the United States. Secretary, J. L. Lyle, 39 Cortlandt St., New York.

American Public Works Association. Secretary, W. H. Flint, Chattanooga.

Association of American Portland Cement Manufacturers. President, J. B. Lober, 1232 Land Title Building, Philadelphia.

National Association of Manufacturers of Sand-Lime Products. Secretary, H. A. Duerr, Wilmington, Del. Next meeting, Dec. 5-7, Detroit.

THE ENGINEERS' CLUB OF NEW YORK.

The Engineers' Club of New York will shortly begin the erection at 32-34 West 40th St. of the large and complete clubhouse for which Messrs. Whitfield & King have prepared the plans. This building is on the south side of Bryant Park, near the Republican Club and the new public library, and backs up on the new building where the leading National engineering and technical organizations, except the American Society of Civil Engineers, will have their offices. The clubhouse is near the Grand Central Station and the new terminal of the Pennsylvania R. R. and is in the heart of the hotel section of the city. It is generally expected, also, that the offices of most engineering and contracting firms will be located in the vicinity before long.

The front of the new building will be of simple classic design, of white marble and red brick. A stylobate will embrace the entire first story, and upon it will rest four Corinthian pillars, running up through two stories and supporting a rich entablature. The first three stories will be built of marble. Then will come six stories of brick, with marble quoins running up the sides of the building. The windows will be decorated with marble architraves, sills and lintels. At the eleventh story there will be an ornamental balcony the full width of the building.

Four engaged columns will separate the tall, arched windows of the banquet hall. Above the building will be finished with marble cornice and balustrade. The café, writing and reception rooms, together with a coat room, will occupy the main floor. The audience room of the club will be at the front of the second story. At the rear will be the library. A billiard room and three-card and committee meeting rooms will occupy the third floor.

The next six stories will contain sixty-six bedrooms, with baths attached. Then will come a floor devoted to private dining rooms, with reception room attached, and to a breakfast room, where all meals before the noon luncheon will be served. The banquet hall, or main dining room, will be on the eleventh floor, and will seat three hundred. The top story will be entirely given over to the service work, and its complement will be most complete.

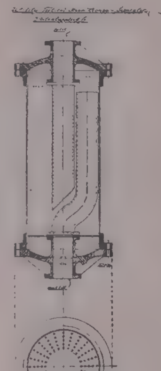
UNDERGROUND RAILWAYS IN BERLIN.

On Wednesday of this week, it is stated in cablegram from Berlin, the Berlin Street Ry. Co., which owns most of the surface railways in the city, decided to increase its capital by $15,000,000 and construct underground lines under Potsdamer and Leipziger Sts. and Unter den Linden, provided that a ninety-year concession could be obtained. Several minor street railways will unite in the project, the cost of which will probably be two or three times $15,000,000.

A NEW VERTICAL STEAM RECEIVER AND SEPARATOR.

The annexed cut shows the latest addition to the line of steam specialties made by the Standard Steam Specialty Co., New York. It is a steam receiver and steam separator combined in one apparatus and gives a storage of steam at the throttle valve several times greater than the displacement of the piston, a feature of much value to an engine running under variable loads, and particularly so when the boilers are located some distance from the engine. This apparatus also prevents wire drawing and the annoyance of vibrating steam mains.

The separation of entrained water from the steam entering the machine is treated in a simple and successful manner. The steam and entrained water enters the machine at a high velocity and is suddenly expanded at the bottom of the receiver, due to a sudden change in volume. The curvature of the return current elbow deflects the mixture of water and steam to the sides and bottom of the receiver, the water gravitating to the bottom of the receiver through the perforated drain plate and from there is taken off by a steam trap. The dry steam rises to the top of the receiver, whence it is drawn off to the engine through the interior supply pipe. The combined feature of suddenly expanding the steam and reversing its current is considered by the makers as the only perfect method for eliminating entrained water from steam conveyed at a high velocity. The construction has been worked out with a view of meeting extreme high pressures common to present engineering practice. The design of all the machines from 2½ up to and including 9 in. is shown in the cut. The receiver shell consists of a seamless rolled steel shell to which flanges are attached either by the welding or Rockwood (Van Stone) process, thus eliminating leaky threads or rivets. The two heads of the machine are cast in one piece, using an extremely high grade of charcoal gun iron for those parts of the machine having a tensile strength of from 28,000 to 30,000 lb. per square inch. In addition these heads are heavily ribbed, eliminating all chances of snapping off the nozzles or springing the heads. The joints between the heads and receiver shell are packed with corrugated copper gaskets and held in place by machine bolts. The interior parts of the machine are flanged to the heads packed with corrugated copper gaskets and bolted up making absolute steam tight joints. Tapped openings for a water gauge will be furnished if required, but the makers recommend in place of a water glass gauge a small pet cock for testing the working order of the discharge from the water chamber. For larger pipe than 9 in. the makers are prepared to furnish special designs covering each individual case.



THE MONARCH ROAD ROLLER CO.

Mr. J. B. Tuck purchased at the trustee's sale on Sept. 14, all the property of the American Road Roller Co., which includes about twelve acres of real estate in Groton, N. Y., on which is located a modern, up-to-date plant, including boiler shop, forge shop, foundry, machine shop, power house, stock room, paint shop, wood shop and warehouse, which gives 100,000 sq. ft. floor space. The power house is equipped with two 150-h.p. boilers, American Ball compound engine with direct connected generator, all the machinery in the plant being operated by electricity. The foundry has two cupolas, the boiler ship is equipped with pneumatic boiler making machinery, and the machine shop with the best machines now used for its class of work, including a full line of boring mills, planers, lathes, milling machines, drills, shapers, etc., and each shop has electric traveling cranes.

The plant was originally erected about four years ago by the Conger Mfg. Co., but has been largely added to and new machines installed by the American Road Roller Co. within the past two years. Mr. Tuck's purchase includes, besides the real estate, plant, machinery and tools, a very large stock of raw material and goods in process of manufacture. Mr. Tuck has just incorporated under the laws of the State of New York the Monarch Road Roller Co., with a capital of $250,000, intending to put the plant in active operation within the next thirty days, and will manufacture road rollers, traction engines, street sweepers, etc.

EXTENSIONS OF THE ATCHISON, TOPEKA AND SANTA FE SYSTEM.

It has been known for some time that a subsidiary company of the Santa Fe system, the Eastern New Mexico Ry. Co., has been pushing construction on a line from Texico to Rio Puerco, N. Mex., a distance of 275 miles. A new company, the Gulf, Santa Fe & Northwestern Ry. Co., has just been incorporated to build a 350-mile line from Texico southeasterly across Texas to Brownwood, on the Gulf, Colorado & Santa Fe Ry. These two lines will give the Santa Fe system a direct route of 2,138 miles from San Francisco to Galveston. This is 46 miles shorter than the Southern Pacific route. The Santa Fe line between Galveston and Los Angeles will be 1,827 miles while the Southern Pacific line is 1,702 miles. The new line will also afford a route from Chicago to the Pacific Coast which avoids the mountain section between Trinidad and Albuquerque.

The Gulf, Santa Fe & Northwestern line will traverse the arid region of the Texas Panhandle known as the Staked Plains, and will have a branch running north to Amarillo on the Pecos Valley Ry., which will help develop this region. Formerly it was considered useless for agricultural purposes, but it is not unlikely that irrigation may render parts of it permanently habitable.

HEAVY ELECTRIC TRACTION BY SINGLE-PHASE APPARATUS.

At the meeting of the American Street Railway Association this week, Mr. Chas. F. Scott read a very interesting paper in which the following notes on single-phase apparatus for heavy electric traction were given:

The development of a new and more efficient method for accomplishing a given result often leads on and opens new fields which had not been commercially practicable before. Such is the case with the single-phase railway. The direct current interurban railway has its limitations. If a region be sparsely settled the available traffic will not show a profit on the cost of circuits and rotary converter sub-stations. There is a material reduction in the investment and operating expense incident to the single-phase railway that will enable it to be built and operated with a profit in cases where the traffic would not support a rotary converter system.

On the other hand, in heavy service the direct current has not made much headway, being handicapped by the heavy cost of sub-stations and of conductors. Heavy and relatively infrequent trains are the hardest loads for sub-stations. For example, if sub-stations be eight miles apart each will supply eight miles of track. A train running forty miles per hour will receive current from a given sub-station for 12 minutes. In order that a sub-station may be continuously supplying current to trains in one direction they must have a headway of 12 minutes. If they be an hour apart the current from each sub-station is used but one-fifth of the time. Trains in two directions will double the sub-station output, but as the peak load is considerable when two trains pass near a sub-station the load factor is extremely low. Therefore, as the aggregate capacity of the sub-stations must be large in proportion to the actual power taken by the cars, it follows that the sub-stations will involve a relatively large expense if they are equipped with expensive rotary converters and require constant attendance, whereas the cost will be relatively small if they require simply lowering transformers having an efficiency very much higher than the rotary converter sub-station and not requiring attendance. The reduction in the sub-station is therefore of especial value when the service is infrequent. Moreover, the single-phase equipment by reducing the size of conductors frequently enables the sub-stations to be more widely separated. This possibility in the reduction in the number of sub-stations and in the aggregate capacity of sub-station equipment, as well as the elimination of rotary converters with their energy losses and their attendants makes practicable the operation of long distance roads which could be operated by direct current only at an excessive cost.

The single-phase system, therefore, decreases the cost of installation and operation for the kind of interurban service which has been successfully developed by the direct current, and it extends the field of commercial operation to include, on the one hand, rural roads with relatively light traffic, and on the other, a heavy, infrequent, multiple unit or locomotive service for passengers or for freight approximating steam railway conditions.

The single-phase railway which shows the most extensive operation as measured in car miles is the Indianapolis & Cincinnati Traction Co. Operation was begun over a short length of track on Jan. 1 and on April 1 37 miles were covered. Since July 1 a regular schedule has been maintained over 41 miles, 37 miles of which is under alternating current trolley and the remaining 4 miles is under direct current trolley in Indianapolis. The company has ten cars each equipped with four 75 h.p. motors. A maximum speed of 60 to 65 miles per hour is secured, and the cars are not only the heaviest, but they operate upon the fastest schedule of any of the numerous surburban roads radiating from Indianapolis. Some defects have developed in the equipment, which, however, have been incidental in character, and not in those new features where trouble might reasonably have been anticipated. The best verdict upon the working of the single-phase system on this road at Indianapolis has been given by the operating company. It is found in the contracts which have been placed for extending the present line a distance of 16 miles; also in extending the single-phase operation to the Shelbyville line, both to the 29 miles which have been operated by direct current and for a 20-mile extension. The length of track is, therefore, to be increased from about 40 to 100 miles; the number of cars will be double the present number and all equipments will be similar. It is significant that a company which has been operating two substantially similar suburban lines, one by single-phase current and the other by direct current, should see fit to throw out the direct current and substitute single-phase alternating current. It may be noted that this course was taken, although the reverse was easily possible, as provision was made in the original contract for the single-phase apparatus by which it would be exchanged for direct current equipments if its operation proved unsatisfactory.

An extension to long distances will soon be shown in the carrying out of the contract which has been closed by the Spokane & Inland Ry. Co. for 150 miles of railway running south from Spokane, Wash. The equipment will consist of 15 motor passenger cars each with four 100 h.p. motors, 6 motor freight cars, each with four 150 h.p. motors and six 40-ton freight locomotives which may be in pairs for heavy trains. The engineer of this road has been intimately connected with the installation and operation of the single-phase road at Indianapolis.

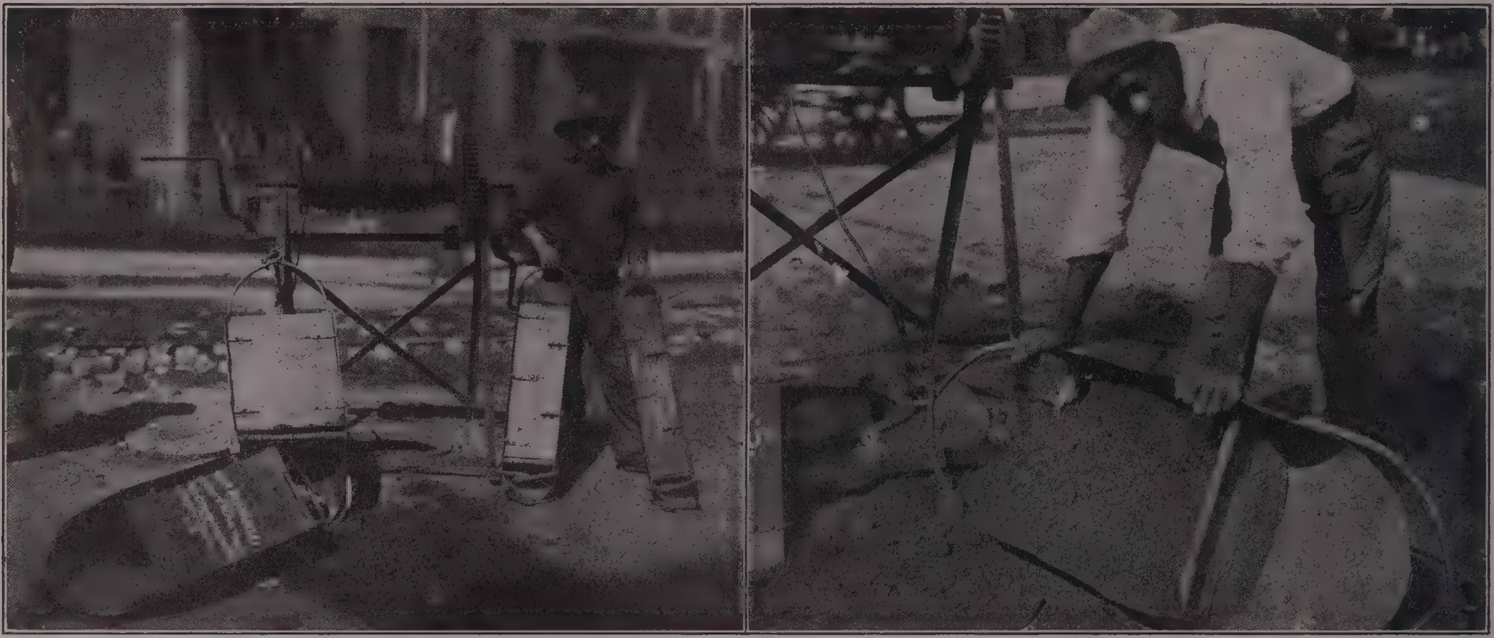
The most notable recent event in electric traction is the purchase of Westinghouse single-phase locomotives by the New York, New Haven & Hartford R. R. The passenger trains on this road which enter Grand Central Station in New York run over the tracks of the New York Central R. R. for about 12 miles. As steam locomotives cannot enter the new terminal station, and as the New York Central is equipping its track for direct current it is imperative that the New Haven trains be handled over 12 miles by direct current power. Instead of changing from electric to steam locomotives for all local and through trains at the end of 12 miles it was decided to extend the electrification and to do it, not by extending the direct current, but by changing to alternating current. The single-phase locomotives will be designed so that they may operate interchangeably from direct current or from single-phase alternating current.

The adoption of the single-phase system by one of the leading railroads of the country for its heavy and important passenger service is all the more noticeable; first, because its officials are already familiar with electric traction matters through the operation of many important city and interurban railways in New England; and, second, because the obvious thing to have done would have been to follow the example of the New York Central by adopting direct current locomotives.

A NEW SEWER CLEANING DEVICE.

A new device for cleaning sewers, whereby the dirt is taken from the pipe and brought to the surface of the street without being handled, is the invention of Mr. R. Shannon, of J. H. & R. Shannon Co., contractors, of Jersey City, N. J. It has been used enough to prove every claim made by the inventor for it. The machine is a very simple device and can be operated by any one, no experience, horses or large gang of men being needed. At Roselle Park, N. J., where 9 miles of sewers at a depth of 23 ft. were cleaned with this machine, and 570 ft. of 15-in. pipe containing from 6 to 12 in. of sand and sewage was cleaned in a day with three men. During this work an average of fourteen cart loads a day was removed. This could not have been done by the old method of taking it out pailfull at a time, but with this machine, as shown in the picture, the contents of the machine are emptied at once. The machine used for the 15-in. pipe holds about seventeen pailsfull. At Harrison, N. J., nineteen loads a day on an average were removed, and at Weehawken, N. J., at a depth of 7 ft. twelve truck loads a day were removed from a 3½-ft. sewer for five days.

The machine is so constructed that with the set any size of sewer can be cleaned. There are no wheels that will allow it to ride over the dirt, but it has four lugs on the bottom to hold it in an upright position in the sewer and make it ride over the joints of the pipe or brick without breaking or causing injury to them. In operating the machine a line is first passed from one manhole to another through the sewer, then a wire cable is drawn through it and the machine connected to the cable. The machine is then drawn into the sewer by a windlass any distance wanted and then withdrawn, and as it comes to the manhole the machine acts as a bucket and is drawn up through the manhole. When drawn all the way up the machine can be swung clear of the street surface and to one side, then the movable cover is removed and the machine dumped by turning it over. The cover is then replaced and the operation repeated till the section is cleaned, when the apparatus is moved to the next section. The machine itself is made of cold rolled steel and has a sharp cutting edge that acts as a shovel and throws all dirt in the sewer to the center of the machine, cutting roots or any other obstruction and picking up the dirt. When the machine is withdrawn the dirt closes a swinging door, which acts as a bucket bottom so that when it is brought to the manhole it can be drawn up to the street, doing away with the handling of the dirt the second time and the expense of taking it up with pails. As the large machine holds about thirty pailsfull this means a saving of about one-half hour every time the machine goes into the pipe, as it will take at least that time to remove that amount of dirt with a pail and rope. The windlasses are geared and two men can easily draw any weight up to seven tons; they are made of one-half inch angle iron and can be moved about by three men. The J. H. & R. Shannon Co., who work this machine, say that they have not met with any sewer they could not clean with it, no matter how full the sewer might be.



TWO VIEWS OF A NEW APPARATUS USED IN REMOVING DEPOSITS FROM SEWERS.

A LARGE FOREIGN RAIL ORDER.

A large contract for American rails for Australia was noticed as follows in the "Argus," of Melbourne, Vic., last month:

"The Victorian Railway Commissioners have accepted the tender of the Lackawanna Steel Co., of the United States, represented by Messrs. R. W. Cameron & Co., as agents, for the supply of steel rails and fishplates, at £5/13/6 per ton for the rails, and £8/9/ per ton for the fishplates.

"The contract is for 6,282¼ tons of steel rails, of which 5,025⅞ tons are 80 lb. per yard, and 1,256⅜ tons are 100 lb. per yard; and 261¼ tons fishplates for 80 lb. rails, of which 118¾ tons are of "A" and 142½ tons are of "B" design. The minimum proportions of carbon are 0.42 per cent. for the 80-lb. rails, and 0.45 per cent. for the 100-lb. rails. At the above prices the total amount of the contract is £37,859. The conditions provide that the manufacture of the rails is to be conducted under the supervision of the inspecting engineers, Messrs. R. W. Hunt & Co., of Chicago. The final inspection and rejection is to be made before shipment; but the rails are deliverable, ex ship's slings, at Williamstown railway pier, the contractors paying freight and insurance (with an approved company), but not duty or landing charges. Payment is to be made in London by the Agent-General against documents.

"In placing the contract with the Lackawanna Steel Co. the Railway Commissioners appear to have secured better terms than would have been obtainable from the European or American associations of manufacturers. Four months ago a South Australian order for 1,500 tons was placed with English makers at about £5/10/ free on board; and two months ago a New Zealand order for 13,000 tons of 50-lb. and 70-lb. rails was placed with Welsh and Northeastern mills at £5/6/3 free on board. Other recent contracts taken by English makers for export have been at about £5/7/6 to £5/8/ free on board. To the cost in these instances must be added freight and insurance, to enable a comparison to be made with the present Victorian purchase at £5/13/6, ex ships slings, at Williamstown. Or, reversing the calculation, the equivalent of the Victorian price, on even a low basis of freight, would probably not exceed £4/17/6 free on board at New York, while the higher the freight to be paid the lower will be the free on board equivalent, though data for an exact calculation are not available. It is quite clear, however, that the Railway department has made an advantageous contract."

PERSONAL NOTES.

Mr. James F. Parr has been appointed assistant engineer of the Missouri Pacific Ry. at St. Louis, Mo.

Mr. H. R. Fardwell, sewer commissioner of St. Louis, has appointed Mr. John C. Pritchard an assistant civil engineer.

Mr. L. J. McIntyre, engineer of the New York terminal division of the Erie R. R., has been appointed assistant engineer of the Chicago & Northwestern Ry. at Chicago.

Mr. R. E. Eberman has been appointed assistant engineer of the Greer Filter Co., of Philadelphia, and Mr. David Davies has been appointed superintendent of construction.

Mr. C. R. S. Kirkpatrick, lately engineer of the Cleveland Bridge & Engineering Co., Ltd., builders of the Zambesi River bridge, has been appointed city engineer of Newcastle-on-Tyne.

The Underwriters' Laboratories, conducted under the direction of the National Board of Fire Underwriters, have been moved from 67 East 21st St. to a new building at 382 Ohio St., Chicago.

The Board of Advisory Engineers of the Isthmian Canal Commission, with the exception of Mr. Alfred Noble, have sailed for the Isthmus in order to inspect the work and conditions there.

Mr. Robert Blickensderfer, who has resigned the position of general manager of the Wabash Pittsburg Terminal and the Wheeling & Lake Erie lines, has been appointed consulting engineer of both roads.

Mr. Frank H. Alfred, M. Am. Soc. C. E., has resigned his position as chief engineer of the Pere Marquette R. R. to become general manager of the Canadian White Co., Ltd., with headquarters in Montreal.

Mr. George L. Warner, assistant engineer, U. S. Reclamation Service, has been transferred from Oklahoma to Carlsbad, N. M. Mr. Henry J. Saunders, assistant engineer, who was employed on the Shoshone project in Wyoming, has resigned.

Mr. P. H. Porcheron has resigned the office of city engineer at Rome, N. Y., in order to accept a Government engineering position at West Point. Mr. John L. Plunkett, assistant engineer, has been promoted to city engineer.

Mr. C. L. B. Anderson has accepted a position as instructor in the hydraulic engineering department of Cornell University. Mr. Anderson is a graduate of Massachusetts Institute of Technology and has had considerable experience in water works and sewerage design and construction.

The firm of Schöndube & Neugebauer has been formed by Mr. Enrique Schöndube and Dr. Francisco Neugebauer to carry on the business of the former in the city of Mexico. The new firm will act as the representative of the Allgemeine Elektricitäts Gesellschaft, A. Borsig and J. M. Voith.

It is understood that Mr. E. G. Connette, vice-president and general manager of the Syracuse Rapid Transit Co., will shortly leave that position to become general manager of the Consolidated Street Ry. Co., of Worcester, Mass. This change was contemplated some months ago, but at that time the directors of the Syracuse company did not care to release Mr. Connette.

Mr. William Pestell has resigned his position with the J. G. White Co., Inc., to become general manager of the Worcester Steel Co., Worcester, Mass. This is a new company which is now fitting up a large establishment for producing special steels. Mr. Pestell was formerly a resident of Worcester, during his connection with the Consolidated Street Ry. Co. of that city.

The duties of Mr. E. H. McHenry, fourth vice-president of the New York, New Haven & Hartford R. R. Co., now include all matters pertaining to the construction and maintenance departments, as well as the electrical department with which he was formerly directly concerned. In the latter department he will be assisted by Mr. Calvert Townley as consulting engineer; Mr. Townley is first vice-president of the Consolidated Railway Co., operating the street railway properties owned by the New Haven system.

Mr. George A. Ricker has been elected president of the Buffalo Testing Laboratory, Prof. Nathaniel W. Shed, vice-president, and Mr. F. M. Turner, secretary. This is a new company with offices at 702 Ellicott Sq. and a laboratory at East Ferry St. It is proposed to carry on general testing and analytical work, including electrical testing. The development of the manufacturing interests in Buffalo has been so great that an establishment of this sort will offer advantages hitherto lacking in the city.

Mr. M. S. Ketchum, professor of civil engineering in the University of Colorado, has been appointed Dean of the School of Applied Science in that institution. Mr. Howard C. Ford has been appointed instructor in civil engineering; he is a graduate of the civil engineering department of the university. Mr. J. H. Wallace, who has been appointed instructor in mechanical drawing, is a graduate of the University of Illinois. Mr. E. C. Evans, adjunct professor of electrical engineering, has been appointed professor of electrical engineering, and Mr. D. R. Jenkins has been appointed instructor in that department, of which he is a graduate.

The Milwaukee Society of Mechanical Engineers, a new organization, has elected the following officers: President, George P. Drave, consulting engineer; vice-president, C. J. Davidson, chief engineer of the Milwaukee Electric Ry. & Lighting Co.; treasurer, E. P. Worden, mechanical engineer of the Prescott Pump Co.; secretary, W. J. Starkweather, with the Allis-Chalmers Co.; directors for three years, M. A. Beck, chief engineer of Pawling & Harnischfeger; H. A. Allen, with Allis-Chalmers; James DeVoy, mechanical engineer of the Chicago, Milwaukee & St. Paul road. For two years, Prof. Warren S. Johnson, of the Johnson Electric Service Co.; C. W. Burkett, chief engineer of the Wisconsin Telephone Co.; George L. Tifft, with Allis-Chalmers. For one year, George M. Conway, consulting engineer; S. L. G. Knox, manager of the Bucyrus Steam Shovel & Dredge Co.; George Warg, manager of the National Blower Co.

Mr. August Ziesing has been formally elected president of the American Bridge Co., in accordance with an official announcement made some weeks ago. He was born in 1858 and was graduated from the University of Illinois in 1878. From 1878 to 1880 he was a draftsman with M. Lassig. From 1880 to 1882 he was bridge engineer and assistant engineer with the Pennsylvania Co. at Pittsburg, and his duties not only included structural work but also relocation and construction on several lines in Ohio. In 1882 he became chief draftsman with the Lassig & Alden Bridge Co. in Chicago, and remained with this company and its successors until 1897, being chief engineer and general manager when he resigned to enter private practice. Since 1900 he has been the Western manager of the American Bridge Co., and has handled this work in a manner which made his selection as president of the company a foregone conclusion when Mr. Major determined to resign.

Mr. A. T. Tomlinson has been transferred from the staff of J. G. White & Co., Inc., New York, to the Canadian White Co., Ltd., Montreal. Mr. Tomlinson graduated from the Royal Military College of Canada in 1882 and spent some time in bridge and railroad engineering in Canada. He was then engaged for six years chiefly in Nebraska and Colorado on railroad location, construction and betterment of way work, after which, in 1891, he became connected with the Brooklyn Elevated Railway Co., where he remained until he went to Chicago in 1894 to take charge of the extension of the Lake Street Elevated R. R. He was later made principal assistant engineer and then assistant chief engineer of the Union Loop & Northwestern Elevated R. R. in Chicago. In 1898 Mr. Tomlinson went to Boston as consulting engineer of the Boston Elevated Railway Co., and had immediate charge of a large part of the construction carried on by that company. He resigned on the completion of that work and entered the service of J. G. White & Co. in 1902.

Mr. Charles Garland has recently resigned the position of secretary of The Westinghouse Machine Co. to become prominently identified with the Pittsburg Fireproofing Co. in the official capacity of vice-president and treasurer. Mr. Garland enjoys the distinction of having remained in the continuous service of one establishment for over 21 years. Arriving in Pittsburg from Ireland in 1883, at the age of 14, he entered the employ of The Westinghouse Machine Co., which at that time had been in existence but three years. From a minor position his advancement more than kept pace with the rapid growth of the company, until in 1896 he was appointed assistant secretary and assistant treasurer. Two years ago he was advanced to the full secretaryship, which he held up to the time of his resignation. The Pittsburg Fireproofing Co., with which Mr. Garland has become identified, is engaged in the manufacture of fireproof materials of many kinds. Its works are located at West Pittsburg, Lawrence County, Pa., and its main offices in the Bailey-Farrell Building, Pittsburg, where Mr. Garland has his headquarters.

BUSINESS NOTES.

The Herron & Bury Mfg. Co., Erie, Pa., has announced the change of its name to the Bury Compressor Co. The company has recently enlarged its shops and increased its facilities, and has added a number of new types and sizes of air and gas compressors and vacuum pumps to its line of standard machinery.

The National Water Wheel Governor Co., Akron, O., is now making three sizes of its solenoid governors. The apparatus is a combination of a simple solenoid movement connected to a lever directly actuating a double-ended cone friction of ample power to move the gates. The company is introducing the device in street railway plants, electric light and power stations, textile and paper mills and factories of all kinds where close regulation of water power is desired.

CONTRACTING NEWS

OF SPECIAL INTEREST TO
CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS
OF ENGINEERING AND BUILDING SUPPLIES.

WATER.

Notes Arranged Alphabetically by States.

Osceola, Ark.—The Town Council is reported to have decided to construct water works.

Lemongrove, Cal.—The Lemongrove Mutual Water Co. is reported incorporated, with a capital of $25,000, to construct and maintain pipe lines, flume lines, reservoirs, etc. Incorporators: T. J. Bryan and M. C. Kennedy, of Lemongrove; B. C. Lockwood, of San Diego, and others.

Los Angeles, Cal.—Wm. Mulholland, Supt. Water Wks., writes that a preliminary bond issue of $1,500,000 for the purchase of land and water rights, has been approved by the people, but it will probably take about 6 months to make the surveys and draw up plans and specifications for the execution of the work.

Fresno, Cal.—A. G. Wishon, of the Fresno Water Co., writes that bids are now being received for 4 and 6-in. hub-end L. W. pipe, to cost about $22,000.

**Denver, Colo.*—Contracts for new electrical and pumping power plant to be installed in Platte Canon below Cheesman dam are stated to have been awarded to the Denver Eng. Works by the Denver Union Water Co., on Sept. 21. It is probable that the new plant, which will be used to pump water from the filter beds in Platte Canon through the pipe line into Capitol hill reservoirs, will be in operation by the middle of February.

**Montrose, Colo.*—Orman & Crook, of Pueblo, are reported to have secured the contract (bids opened Aug. 28) for constructing about eight miles of main distributing canal from Gunnison Tunnel to a point on Uncompahgre River about nine miles south of Montrose, consisting of the excavation of 525,000 cu. yd. material and the placing of 20,000 cu. yd. concrete masonry. For list of detail bids received for this work see issue of The Engineering Record Sept. 9. I. W. McConnell, engr. in charge.

Cripple Creek, Colo.—The Colorado Fuel & Iron Co. is reported to be considering the construction of a reservoir, to cost about $200,000.

Cochran, Ga.—See "Power Plants, Gas and Electricity."

Lewiston, Idaho.—The Lewiston-Sweetwater Irrigation Co. has been formed to construct an irrigation plant for the purpose of watering about 3,000 acres of land directly south of Lewiston. Sites have already been secured for the reservoir, most of the rights of way have been obtained, and contracts will soon be let. J. O. Maxon, of Lewiston, Ch. Engr. For further information address H. L. Powers, Room 3, Chamber of Commerce Bldg., Portland, Ore.

**Rexburg, Idaho.*—The contract for constructing water works (bids opened Sept. 18) has been awarded to Hanley & Ritchie, of Topeka, Kan., for $19,360. Engineer, Louis C. Kelsey, 414 D. F. Walker Bldg., Salt Lake City, Utah.

Libertyville, Ill.—Bids will be received until Oct. 5 the Bd. Local Improv. (Paul McGuffin, Pres.) for laying 3,050 ft. 8-in., 28,650 lin. ft. 6-in., and 612 lin. ft. 4-in. c. i. pipe with hydrants, valves, etc., as advertised in The Engineering Record.

Chicago, Ill.—Bids will be received until Oct. 3 by the Bd. Local Improv. (And. M. Lynch, Pres.) for constructing water service and supply pipes in portions of 13 streets.

St. Charles, Ill.—Chas. A. Miller, of the Water Com., writes that it is proposed to construct water works; probable cost, $40,000.

West Terre Haute, Ind.—The Town Council is reported to have granted Burton Cassidy and Chas. Ehrmann, a franchise for water works.

Davis, Ind. Ter.—An election will probably soon be held to vote on issuing $25,000 bonds for water works. Engineer, J. W. Bullock.

Wynnewood, Ind. Ter.—See "Power Plants, Gas and Electricity.

**Ames, Ia.*—The contract for constructing an extension to the water works (bids opened Sept. 4) has been awarded to the Des Moines Bridge & Iron Co., of Des Moines, for $32,689. Engineer, A. Marston, of Ames.

**Shellsburg, Ia.*—The National Constr. Co., of South Bend, Ind., is reported to have secured the contract for constructing an air pressure system of water works for Shellsburg.

**Onawa, Ia.*—Contracts for material for extending the water works are stated to have been awarded as follows: To the U. S. Cast Iron Pipe & Fdry. Co., of Chicago, Ill., for the pipe, and to L. M. Rumsey, of St. Louis, Mo., for hydrants, etc.

Lakin, Kan.—F. R. French, Mayor, writes that it is proposed to construct a reservoir at this place. Mr. McKinnie, of Garden City, Kan., is reported interested.

Eldorado, Kan.—J H. Austin, City Engr., writes that this city has purchased the water plant and will issue bonds for the purchase price and for betterments and extensions. A new standpipe or elevated tank will be constructed.

Williamsburg, Ky.—L. C. Steely, City Clk., writes that a water works franchise has been granted to Cleaver Taylor, of Lynchburg, Va.

**Owensboro, Ky.*—The contract for the water supply and suction pipe system across and underneath Ohio River, at Owensboro, has been awarded as a whole to Jos. G. Falcon, of Evanston, Ill., by the Owensboro Water Works Co. Owen Ford, Consulting and Superv. Engr., 710 Security Bldg., St. Louis, Mo.

New Orleans, La.—Bids will be received until Oct. 21 by Mordecai G. Endicott, Ch., Bureau Yards and Docks,

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**Items marked thus give the names of parties awarded contracts.*

Navy Dept., Washington, D. C., for drilling an artesian well at the naval station, New Orleans; estimated cost, $[illegible],800.

Moberly, Mo.—Richard H. Phillips, Security Bldg., St. Louis, is preparing estimates on the cost of municipal water works for Moberly. The franchise with the water company will shortly expire, and the city is preparing to construct a municipal plant, unless the water company makes extensive improvements.

Annapolis, Md.—Bids will be received until Oct. 11 at the Navy Dept., Washington, D. C., for a reservoir at the Naval Academy, Annapolis.

Fitchburg, Mass.—The Water Comrs. are stated to have petitioned City Council for authority to extend the supply main from a point near Smith reservoir in Westminster to Wachusett Lake; probable cost of construction, land, etc., is $49,900.

**Falmouth, Mass.*—The following are reported to be the bids opened Sept. 4 by the Water Comrs. for laying 3½ miles of 6 and 8-in. pipe: P. Arthur McIntyre, of Milton, $4,797 (awarded contract); David R. Courtney, $5,297; Bruno & Milano, $5,605; R. C. Brown & Co., $6,434, and Frank A. Foster & Co., $6,736.

Great Barrington, Mass.—The citizens are reported to have voted to issue $5,000 to be used for raising the dam at East Mountain reservoir and making general repairs there.

**Lowell, Mass.*—Robt. J. Thomas, Supt. Water Bd., writes that the Holly Mfg. Co., of Buffalo, N. Y., on Sept. 18 secured the contract for furnishing an 8,000,000-gal. vertical triple-crank and flywheel pumping engine for $19,700.

Escanaba, Mich.—L. E. Chapin, of Canton, O., is stated to have prepared plans for a filter plant, to cost about $50,000, which the Escanaba Water Co. proposes constructing, if franchise is extended.

Fergus Falls, Minn.—G. A. Gard, City Clk., writes that the citizens voted Sept. 19 to issue $89,000 bonds or as much of same as may be necessary for the purchase or construction of water works.

**Ely, Minn.*—Engle & Runquist are reported to have secured the contract for extending the water system for $11,775.

St. Louis, Mo.—On account of a technical error in lowest bid opened Sept. 13 by the Bd. of Pub. Improv. for the new reservoirs, all bids were rejected and new bids will be received on Oct. 10. The lowest bid received amounted to $437,000. Benj. C. Adkins, Water Comr.

Glendive, Mont.—Plans and specifications are on file at the office of The Engineering Record, 114 Liberty St., New York, N. Y., for the construction of the Lower Yellowstone dam, located about 18 miles northeast of Glendive, bids for which will be received at the office of the U. S. Reclamation Service at Billings on Dec. 5, as advertised in The Engineering Record.

Leigh, Neb.—The citizens are reported to have voted Sept. 13 to issue $8,000 bonds for water works.

**Garfield, N. J.*—The detail bid of J. C. Tierney, of Bogota, N. J., the lowest and successful bidder for the work of constructing the reservoir (bids opened Sept. 20), is as follows: For constructing reinforced concrete reservoir complete, $4,925; 4-in. drain pipe, 25 cts. per lin. ft.; trench not over 4 ft. 6 in. deep, 20 cts.; trench 4 ft. 6 in. to 6 ft. deep, 30 cts.; rock excav., $1.50 per cu. yd.; earth excav., 52 cts. per cu. yd., and 12-in. c. i. pipe, $1.80 per lin. ft. The other bids received were: Goodwin Constr. Co., 60 Wall St., N. Y. City, $5,476; Bell Eng. & Constr. Co., 220 Bway, New York, N. Y., $9,470; Hinman & Sproul, Schenectady, N. Y., $6,828; J. T. Harrop & Jacob A. Troast, Garfield, $5,274, and Abbott-Gamble Co., 32 Bway, New York, $5,299. Engineers, Wise & Watson, Passaic.

**Perth Amboy, N. J.*—Adam Eckert, Clk. Bd. Water Comrs., writes that the contract for furnishing an 8,000,000-gal. pumping engine (bids opened Aug. 30) has been awarded to Henry R. Worthington, New York, N. Y., for $14,400.

Orange, N. J.—Fred. T. Crane, City Engr., writes that bids will be received by the Common Council until Oct. 9 for the new water distributing system; probable cost of work, $200,000. It is proposed to construct a distributing reservoir and lay about [illegible],000 ft. 20-in. c.-i. mains and 19,000 ft. of 24-in. c.-i. mains and appurtenances. Alternative bids will be received for 19,000 ft. 30-in. c.-i. mains, etc.

**Albany, N. Y.*—The following are reported to be the bids opened on Sept. 18 by the Bd. of Contract and Supply for constructing an intake for the filtration plant: Albany Material & Constr. Co., $32,442 (awarded contract); the Cameron & Hawn Realty Co., $35,958; M. F. Dollard, $43,997, and Brown & Low, $54,425.

Lakewood, N. Y.—Bids will be received until Oct. 9 by Ralph H. Maxson, Village Clk., for furnishing material and constructing a system of water works. Bids to be submitted separately on the following: 358 tons of pipe and specials; 50 hydrants; 20 valves and 1 concrete reservoir. C. G. Jones, Engr., Jamestown, N. Y.

Sherburne, N. Y.—It is proposed to expend about $9,000 in repairing the damaged reservoir, all work to be done by day labor under the direction of the engineer, C. F. Musson, of Norwich, N. Y.

New York, N. Y.—Bids will be received until Oct. 11 by John T. Oakley, Comr. Water Supply, Gas and Electricity, for furnishing, delivering and laying water mains in portions of several streets, Boros. Manhattan and Bronx.

Brooklyn, N. Y.—Bids will be received until Oct. 11 by John T. Oakley, Comr., Water Supply, Gas and Electricity, New York City, for furnishing, delivering and laying a 30-in. water main in Ave. S and E. 16th St.; furnishing and delivering stop-cocks; furnishing and delivering vitr. salt-glazed stone ware, hub and spigot pipe, all in Boro. Brooklyn; also same date for furnishing and erecting 2 steel smoke stacks at the Massapequa pumping station, near Massapequa, L. I., and 3 steel smoke stacks at the Merrick Pumping Station, near Merrick, L. I.

Coxsackie, N. Y.—Robt. Hood, of Kingston, with the Water Comn., is stated to have visited various sources of water supply in the vicinity of Coxsackie, with a view to increasing the water supply of the village.

Lockport, N. Y.—The American Pipe Co., of Philadelphia, Pa., is stated to have submitted a proposition to furnish water from Lake Ontario, at 6 cts. per 1000 gals. The company will build the plant, and at the end of 30 yrs., it is to be turned over to city.

Buffalo, N. Y.—Francis G. Ward, Comr. of Pub. Wks., has recommended that the contract for installing at the pumping station two 30,000,000 vertical triple expansion engines (bids opened Sept. 12) be awarded to the Holly Mfg. Co., of Buffalo, for $224,750.

Lyon Falls, N. Y.—Bids are wanted Oct. 12 for the construction of a water system, as advertised in The Engineering Record.

Buford, N. D.—Bids will be received at the office of the U. S. Reclamation Service at Glendive, Mont., until Nov. 15 for the construction of about 33 miles of main canal and about 74 miles of branches and laterals between Newlon, Mont., and Buford, N. D., as advertised in The Engineering Record.

**Reading, O.*—C. V. Dils, Clk. Bd. Pub. Affairs, writes that the contract for 80 tons of 4-in. c. i. pipe and 2 tons of c. i. special castings has been awarded to the American Car & Fdy Co., of Detroit, Mich., at $27.45 per ton and $2.60 per cwt., respectively.

East Liverpool, O.—It is stated that bids will be received until Oct. 3 by the Bd. Pub. Service (J. W. Gipher, Secy.) for furnishing material and laying about 930 ft. 10-in. and 330 ft. 8-in. main.

**Columbus, O.*—The Bd. of Pub. Service is reported to have on Sept. 22 awarded to the Holly Mfg. Co., of Lockport, the contract for the machinery and equipment of the water purification and softening plant, for $270,000.

Leesburg, O.—The citizens have voted to construct water works to cost about $16,000. Drilling has commenced for water supply and bids for construction will be called for about Oct. 16. Engineer, G. L. McKibben of Van Wert.

McMinnville, Ore.—Wm. Bostaph, of Ogden, Utah, is reported to have been selected as engineer for the proposed water works for McMinnville, to cost about $75,000.

Corvallis, Ore.—J. F. Yales, Police Judge, writes that bids will be received Oct. 9 for the construction of a gravity system of water works; probable cost, $75,000. Engineer, G. N. Miller.

Manila, P. I.—Specifications are on file at the office of The Engineering Record, 114 Liberty St., New York, N. Y., for furnishing material and constructing a gravity water supply system for the city of Manila, bids for which will be received by G. S. Lane, Acting Secy. of the Municipal Bd., until Jan. 2, 1906. The proposed work will consist of a masonry dam and inlet chamber; a steel pipe line, 42-in. diameter, and approximately 10½ miles long; a masonry conduit in tunnel and open cut about 4½ miles long; a receiving and distributing reservoir; and the necessary gates, gate houses and appurtenances. Specifications, general plans and blank forms of proposal may be obtained at the office of the Secy. of the Municipal Bd. at Manila, or from the Chief of the Bureau of Insular Affairs, Washington, D. C. J. F. Case, Ch. Engr., Dept. of Sewer and Water Wks. Construction, Manila.

Reading, Pa.—Press reports state that bids will be received until Oct. 12 by the Bd. Pub. Wks., for the increasing of, and alterations to the disposal plant. It is the intention to have the capacity of the plant increased from 1,500,000 gals. to 7,000,000 gals. every 24 hours; appropriation, $24,500.

Philadelphia, Pa.—The Bureau of Filtration (Geo. S. Webster, Acting Chief Engr.) is preparing specifications for the low-service pumping machinery for the Torresdale filters.

Bids on contract No. 81, for pumping out Torresdale Conduit, will be opened at Room 412, City Hall, on Oct. 3, by the Dept. of Public Works, Bureau of Filtration (Geo. S. Webster, Acting Ch. Engr.)

The appropriation estimate of the Bureau of Water, which has been referred to the Finance Com., is reported to contain the following items for new work: $100,000 for extending the high-pressure fire main system; $370,000 for increasing the capacity of Belmont Pumping Station; $313,000 for increasing the capacity of Roxborough Pumping Station; $51,000 for increasing the Roxborough High-Service Station, and $26,000 for a high-service station at Belmont.

Hartsville, S. C.—H. A. Edwards, Mayor, writes that a survey is being made with a view to constructing water works and a sewerage system. Engineer, C. C. Wilson.

Bamberg, S. C.—See "Power Plants, Gas and Electricity."

Jacksonville, Tex.—The Mayor writes that bids will be received until Oct. 10 for the construction of water works, to cost about $28,000. Engineer, F. C. Hand, of Corsicana, Tex.

Ft. Worth, Tex.—The following are reported to be the bids received on Sept. 9 for the construction of a 2,000,000-gal. reservoir for the water works: R. K. Dabney, $13,500; Leversedge Bridge Co., $12,900, and the McQuatters Plumbing Co., $14,800.

Wichita Falls, Tex.—I. Kempner and M. Lasker, of Galveston, and Henry Sayles, of Abilene, principal stockholders in the Lake Wichita Irrigation Co. and the Water & Light Co., of this city, are reported to be here to contract for extension of water mains and other improvements.

Pleasant Grove, Utah.—Bids will be received until Oct. 12 by the Mayor and City Council for constructing water works, as advertised in The Engineering Record.

Logan, Utah.—The City Council is reported to be considering the question of increasing the water supply; probable cost of work proposed, $25,000.

Ft. Ethan Allen, Vt.—Bids will be received until Oct. 19 by Capt. T. B. Lamoreux, Q. M., U. S. A., Burlington, for sinking not less than 2 or more than three 8-in. tubular wells and for piping same, at Ft. Ethan Allen, as advertised in The Engineering Record.

Tacoma, Wash.—The Council has adopted the report of the Special Water Com., recommending that $10,000 be expended for a preliminary survey for a gravity water system, and it is stated that the work will commence at once on surveying a line for a waterway between Tacoma and the Green River and Greenwater River.

Seattle, Wash.—L. B. Youngs, Supt. of the Lighting and Water Dept., is reported to be looking up possible sites for two new reservoirs in the 9th Ward. One is to be known as the low-service and the other as the intermediate service, cost of both to be $200,000. It is also reported that a reservoir is to be constructed for Woodland Park and a high-service standpipe for Volunteer Park.

Benwood, W. Va.—Wilbur Schofield, Supt. Benwood Water Co., writes that it is proposed to double the capacity of the filtration system. Engineer, L. E. Chapin, of Canton, O.

Barbourville, W. Va.—D. B. Shaw, of Barbourville, Pres. Cabell Investment & Development Co., writes that it is proposed to construct water works here, at a cost of from $8,000 to $15,000. No engineer selected as yet.

Readstown, Wis.—Bids will be received until Oct. 5 by H. M. Pond, Village Clk., for one 12-h.p. gasoline engine, 1 single acting, 150-gal. triplex pump, laying 4,000 ft. 6-in. c. i. water pipe and setting 8 hydrants and 4 valves. W. G. Kirchoffer, Engr., Madison.

Port Washington, Wis.—See "Power Plants, Gas and Electricity."

Keshena, Wis.—See "Schools."

**Cody, Wyo.*—The contract for constructing the Shoshone dam near Cody (bids opened Sept. 5 by the U. S. Reclamation Service) (H. N. Savage, Engr., Billings) has been awarded to Prendgergast & Clarkson, 32 La Salle St., Chicago, Ill., for $515,730. Chas. Spear, of Billings, secured the contract for constructing Corbitt tunnel near Cody (bids opened Sept. 6) for $594,325. For list of bids received for this work see issue of The Engineering Record, Sept. 16.

SEWERAGE AND SEWAGE DISPOSAL.

Notes Arranged Alphabetically by States.

**San Jose, Cal.*—The College Park Sanitary Bd. is reported to have awarded to Chas. Wehner, of San Jose, the contract for about 13 miles of sewers, at a cost of $47,000.

Redding, Cal.—It is reported that a new election will probably be held to vote on issuing $170,000 bonds for street and sewerage improvement.

Lake City, Fla.—Bids will be received until Oct. 29 by the Bd. Bond Trus. (J. C. Sheffield, Chmn.) for furnishing material and constructing a sanitary sewerage system. Work embraces approximately 7 miles of pipe sewers from 6 to 12-in. in diameter. W. W. Lyon, Consulting Engr., Palatka, Fla.

Dawson, Ga.—The question of constructing a sewerage system is reported under consideration here.

Glencoe, Ill.—Bids will be received until Oct. 10 by the Village Council for constructing and installing a sewerage purification plant. Said plant is to be a gravity plant, and to provide for a flow of 40,000 gals. of sewage per 24 hours, the effluent therefrom to be free from objectionable odors and organic matter. Frank A. Windes, Engr., Winnetka, Ill.

Chicago, Ill.—The following are the bids opened on Sept. 23 by the Bd. of Pub. Wks. for constructing approximately 1,320 ft. of 14x20-ft. intake tunnel under the shoal water of Lake Machigan at Lawrence Ave.; price given per lin. ft. complete: M. H. McGovern, Chamber of Commerce Bldg., $147.50; Nash Bros., 88 La Salle St., $249; John B. Agnew, $138.33; Jackson & Corbett Co., $205; Union Paving Co., $155; McNichols & Cogan, $221.

Bids will be received until Oct. 14 by the Dept. Pub. Wks. (J. M. Patterson, Comr.) for furnishing material and reversing a portion of the 73d St. sewer.

The Bd. of Local Improv. (C. D. Hill, Engr.) has rejected all bids opened on Sept. 6 for the construction of a system of concrete sewers in 95th St. and adjoining streets, also for the sewage pumping station, including centrifugal pumps. The reason for rejection was that the bids exceeded the assessment and that there were only two bids received. No date has yet been set for the receiving of new bids. The lowest bid received was that of Conway & Co. for $855,880.

Rockport, Ind.—It is reported that plans are being prepared for a sewerage system.

Greenfield, Ind.—The City Engineer is reported to have been authorized to prepare plans for a sewer in the eastern part of city.

Princeton, Ind.—Press reports state that bids will be received until Oct. 20 by the City Council for furnishing plans and specifications for a sewerage system.

**Davenport, Ia.*—The Peoples' Constr. Co. is reported to have secured the contract for constructing a system of lateral sewers bet. Brady and Farnam Sts. (bids opened Sept. 19) for $12,626.

Cleveland Heights, O.—Bids will be received until Oct. 24 by Wm. G. Phare, Village Clk., 402 Am. Trust Bldg., Cleveland, for furnishing materials and constructing sewers in portions of 11 streets; the Wm. H. Evers Engr. Co., Engrs., 257 The Arcade, Cleveland.

Lisbon, O.—Bids will be received until Oct. 9 by the Bd. Co. Comrs. (Eden Reeder, Chmn.) for furnishing material and constructing a stone box culvert with vertised in The Engineering Record. Estimated cost $35,000.

Items marked thus give the names of parties awarded contracts.

**Carroll, Ia.*—The following are the bids opened Sept. 18 for constructing a sewage disposal plant and sewers at Carroll: O. P. Herrick, Des Moines, $9,000; R. C. De La Hunt, Cedar Rapids, $8,242; W. D. Lovell, Minneapolis, Minn., $7,900; Fred J. Franzwa, Carroll, $7,643 (awarded contract). This work consists of a septic tank of about 80,000 gals. capacity, with centrifugal sludge pump; 2 sand filter beds each containing 13,000 sq. ft. of surface, and of about 770 ft. of 18-in. sewer leading to the same. Engr., A. Marston, Ames.

Coldwater, Mich.—It is reported that bids are wanted until Oct. 3 for constructing about 4,614 ft. storm sewer in Montgomery St. W. H. King, City Clk.

Jackson, Mich.—Bids will be received until Oct. 12 by the Bd. Pub. Wks. for furnishing material and constructing intercepting sewers, a sewage pumping station and sewage purification works; also on same daate for building an extension to 3d Ward Sewer, both advertised in The Engineering Record.

Crookston, Minn.—Bids will be received until Oct. 10 by J. E. Carroll, City Engr., for constructing a vitr. clay pipe sewer in a portion of Woodland Ave.

St. Paul, Minn.—Bids will be received until Oct. 3 by the Bd. Pub. Wks. (R. L. Gorman, Clk.) for constructing a sewer in a portion of Mt. Airy St.

Winnebago City, Minn.—The Village Council has granted John Sharp, P. J. McGuiggan and B. G. Reynolds a franchise for a sewerage system.

Kirkwood, Mo.—T. J. Byrne, 3125 Sheridan Ave., St. Louis, has some sewer work to let at Kirkwood. Advertised in The Enginering Record.

St. Louis, Mo.—The lowest bid opened on Sept. 15 by the Bd. of Pub. Improv. for the reconstruction of 13th St. sewer is stated to have been submitted by John F. Mahon for $36,000.

Dillon, Mont.—Geo. R. Metten, City Engr., is reported to be preparing plans and specifications for the construction of about 5,000 ft. of 8-in. main sewer, to be constructed this fall.

Camden, N. J.—The question of constructing a trunk sewer to cost $75,000 is reported under consideration here. L. E. Farnham, City Engr.

Cape May, N. J.—Bids will be received by the City Council Oct. 16 for the construction of sewers, to consist of 6,120 lin. ft. c. i. pipe sewer, with manholes, junction manholes and house connection branches, as advertised in The Engineering Record.

New Brunswick, N. J.—Bids are wanted until Oct. 9 for constructing a sewer in a portion of Jersey Ave. Saml. G. Farrell, Street Comr.

Newark, N. J.—The present sewer in the vicinity of Boyd St. is too small, and in a recent report, Edw. S. Rankin, Engr. Dept. Sewers and Drainage, recommended increasing the capacity, partly by building an additional parallel sewer and partly by removing old arch and enlarging with a square reinforced concrete construction. Plans will probably be prepared, but no work done before next season. If constructed, it will be of brick and concrete; according to press reports the cost will be $90,000.

Haddonfield, N. J.—Bids will be received until Oct. 4 (extension of date) by J. Morris Roberts, Mayor, for constructing about 2 miles of 3 to 12-in. pipe sewers, a sewage receiving well, and approximately 2,000 ft. c. i. force main, as advertised in The Engineering Record.

Jersey City, N. J.—Bids will be received until Oct. 2 by the Bd. Street and Water Comrs. (Geo. T. Bouton, Clk.) for constructing a sewer in a portion of West Side ave.: Engineer's approximate estimate: 1,505 lin. ft. 72, 66, 57, 36 and 48-in. circular brick sewer; 135 lin. ft. 18-in. vitr. pipe sewer; 12,800 ft. B. M. flooring, per M. ft.; 40,000 ft. sheating per M. ft., etc.

Long Island City, N. Y.—The Bd. of Estimate is reported to have on Sept. 22 adopted the drainage map for the St. Nicholas Ave. tunnel, which is reported to be the first step toward the construction of a sewer which will practically drain all of Queens Boro., and a large section of the 27th and 28th Wards of Brooklyn, Boro.; probable cost of sewer, $4,000,000, of which three-quarters of cost will be contributed by Queens Boro.

Syracuse, N. Y.—The Onondaga Creek Comn. is stated to have decided to recommend to Council the construction of an intercepting sewerage system for the entire city and the abolition of Onondaga Creek as a trunk sewer; total cost of work proposed is about $750,000.

**Ballston Spa, N. Y.*—The contract for constructing the sewage plant (bids opened Sept. 7 by the Bd. of Village Trus.) has been awarded to Brown & Lowe, of Schenectady, for $100,687. Engineer, John M. Farley, of White Plains. For list of detail bids received for this work see issue of The Engineering Record, Sept. 23.

Albany, N .Y.—Mayor Gans has approved the ordinance providing for the construction of a vitrified pipe sewer on Grant Ave. from 3d St. north.

Batavia, N. Y.—The Bd. of Sewer Comrs. is reported to have adopted the plans of Alex Potter, of New York City, for a complete system of sewers, which will cost about $230,000. The plans are reported to have been forwarded to the State Bd. of Health and if approved will be submitted for adoption at the election, Nov. 7.

**Dayton, O.*—M. J. Gibbons, of Dayton, secured the contract for a brick pump house for $2,295, and the Dayton Hydraulic Machine Co., of Dayton, for a sewage pumping plant (bids opened by the Bd. Public Affairs, Sept. 26. F. M. Turner, City Engr.

Portsmouth, O.—Bids will be received until Oct. 26 by the Bd. Pub. Service for constructing a main sewer, manholes, catch basins, branches, etc., and outlet on Robinson Ave., from Lincoln St. to Lawson Run, as adwing walls on the line of the townships of Salem and Butler.

Chagrin Falls, O.—An election will probably soon be held to vote on issuing $15,000 bonds for constructing a sewerage system and sewage disposal plant.

Cincinnati, O.—Bids will be received until Oct. 4 by the Bd. Pub. Service (Geo. F. Holmes, Clk.) for furnishing material and improving a portion of Clifton Ave., by constructing sewers and drains.

Bids will be received until Oct. 6 by the Bd. Pub. Service (Geo. F. Holmes, Clk.) for furnishing material and constructing sewers and drains in portions of Charlotte St. and Keywitt Alley.

Bids will be received until Oct. 10 by the Bd. Pub. Service (Geo. F. Holmes, Clk.) for furnishing materials and constructing sewers in a portion of Div. 16.

The following are reported to be the bids opened on Sept. 21 by the Bd. of Pub. Service for the Bloody Run and Ross Run sewer extension from its present terminus to the Millcreek at St. Bernard and Ivorydale, a distance of 3 miles: McCarthy Bros., $183,058; Henkel & Sullivan, $188,825; Kirchner Constr. Co., $203,808, and Wm. Heffron Constr. Co., $285,908.

Manila, P. I.—Specifications are on file at the office of The Engineering Record, 114 Liberty St., New York, N. Y., for the construction of a system of sewers and appurtenances, bids for which will be received until Jan. 12, 1906, at the office of the Municipal Board at Manila (G. S. Lane, Acting Secy.). The total length of sewers will be approximately 52 miles, of which 7.5 miles will be of brick and concrete, ranging from 4.75 ft. diameter to 2x3 ft., egg shaped, and laid at depths from 12 to 20 ft. below surface; 43 miles will be pipe sewers, from 8 to 24 in. diameter, laid at depths of 5 to 18 ft. In addition to this there will be one 42-in. c. i. outfall pipe, 6,500 ft. in length, laid below bed of harbor on pile foundation, and one double line of 24-in. flexible-joint c. i. pipe, 650 ft. in length, crossing Pasig River. Specifications, general plans and blank forms of proposals may be obtained at the office of the Municipal Bd. at Manila. J. F. Case, Ch. Engr., Dept. of Sewer and Water Wks. Construction, Manila.

**Reading, Pa.*—The following are totals of bids opened Sept. 14 by the Bd. of Pub. Wks. for the construction of the house sewer main from Pine and Mifflin Sts. to 2d and Penn Sts. (*a*) 54-in. brick sewer; (*b*) 54-in. concrete, plain: (*c*) 54-in. concrete, reinforced: Jos. P. O'Reilly, Reading, *a* $29,992, *b* $22,940 (awarded contract), *c* $22,648; T. H. Bowman, 606 Arcade Bldg., Philadelphia, *a* $33,662; *b* $31,466, *c* $30,612; David Peoples, 1000 Betz Bldg., Philadelphia, *a* $36,676, *b* $29,660, *c* $36,432; Harrison Constr. Co., 745 Broad St., Newark, N. J., *a* $31,862, *b* $29,666, *c* $26,860; J. B. Waidelich & Co., Allentown, *a* $34,906, *b* $38,200, *c* $39,420; R. A. Malone, Lancaster, *a* $50,452, *b* $46,304, *c* $48,183. Jos. P. O'Reilly, the successful contractor, bid $7.42 per lin. ft. for 2,440 lin. ft. 54-in. plain concrete sewer; $3.03 per vertical ft. for manhole with cover, and $26 per M. ft. for 100 M. ft. lumber.

*The detail bid of the successful bidder, David Peoples, of Philadelphia, for the construction of house sewers in Districts Nos. 3½, 4, 5, 6 and 11, bids for which were opened by the Bd. of Pub. Wks., on Sept. 14, is as follows: For furnishing and laying pipe, per lin. ft.: 1,656 ft. 20-in., $1.02 and $1.05; 2,750 ft. 15-in., 60 cts. and 61 cts.; 13,705 ft. 12-in., 39 cts. and 15,303 ft. 12-in., 40 cts; 41,960 ft. 10-in., 28 cts.; 51,680 ft. 10-in., 29 cts.; 95,170 ft. 10-in., 30 cts. and 46,400 ft. 10-in., 31 cts.; 8,410 ft. 8-in., 24 cts.; 1,368 ft. 8-in., 21 cts. and 3,960 ft. 8-in., 23 cts.; 2,236 ft. 6-in., 13 cts. and 360 ft. 6-in., 14 cts.; 235,175 ft. 5-in., 11 cts. Concrete Cradle, in place, per lin. ft.: 1,256 ft. 20-in., 52 cts.; 950 ft. 15-in., 39 cts.; 10,300 ft. 12-in., 35,613 ft. 10-in. and 2,600 ft. 8-in., all at 30 cts. per ft.; 380 ft. 6-in., 20 cts. and 24,000 ft. 5-in., 10 cts. For each extra "Y" branch in place, 20 for 12-in pipe, $3 ea.; 30 for 15-in. pipe at $1.70 ea.; 100 for 12-in. pipe at $1.25; 875 for 10-in., ea. 95 cts. and 50 for 8-in. pipe, ea. 65 cts. Manholes with cover: 12,500 at $4.25 per vertical ft. Excav., including back fill: 164,850 cu. yds. earth, 78 cts.; 22,500 cu. yds. loose rock, 90 cts., and 61,550 cu. yds. rock, $1.60. Borrowed embankment 60 and 70 cts. per cu. yd. and for lumber, 875 M. ft., $24 per M. ft. For extra work he submitted the following figures: Masonry, 700 cu. yds. brick, $12; 230 cu. yds. vitrified, $16, and 48 cu. yds. rubble stone, $5; Concrete, 2,300 cu. yds., $4.50; Lumber, 133 M. ft., $24 per M. ft. Excav., including back fill.: 16,200 cu. yds. earth, $1; loose rock, $1.50, and for 8,600 cu. yds. rock, $2.50. The totals of this bid, according to districts, also totals of all other bids received, are as follows: (*a*) 3½ Dist., (*b*) 4th Dist., (*c*) 5th Dist., (*d*) 6th Dist., (*e*) 11th Dist.: Hawman Bros., Reading, *a* $178,954, *b* $114,904, *c* $146,730, *d* $119,920, *e* $131,636. David Peoples, Philadelphia, *a* $148,999, *b* $93,067, *c* $116,388, *d* $100,257, *e* $114,435. Jos. P. O'Reilly, Reading, *b* $116,735, *e* $131,235. Hawman Constr. Co., Reading, *e* $135,478. Fehr & O'Rourke, Reading, *b* $153,590, *c* $104,069, *d* $115,174. Wm. A. Ryan, Philadelphia, *b* $150,547, *c* $153,590.76; J. B. Waidelich, Allentown, *a* $195,948, *b* $104,165, *c* $161,652, *d* $120,289, *e* $137,155. Harrison Constr. Co., Newark, *b* $111,713, *e* $135,741. T. H. Bowman, Philadelphia, *a* $220,570, *b* $130,843, *c* $166,898, *e* $158,531. Climax Constr. Co., New York, *a* 189,483, *c* $152,172, *e* $128,755.

Indiana, Pa.—The City Council is stated to have passed ordinances providing for the construction of 3 new sewers.

New Castle, Pa.—As soon as permission is obtained from the State Dept., it is proposed to construct pipe sewers, at a cost of $25,000. C. H. Mulholland, City Engr.

Pittsburg, Pa.—Local press reports state that under direction of E. M. Bigelow, Dir. Dept. Pub. Wks., plans are being prepared for reconstruction of the main sewer under 5th Ave. from the Soho district to the downtown district; probable cost of work, about $600,000.

Hartsville, S. C.—See "Water."

**Sioux Falls, S. D.*—S. B. Howe, City Engr., writes that the contract for sewer improvements (bids opened Sept. 19) has been awarded to Syms Powers Co., of Sioux Falls, for $3,800.

Galveston, Tex.—The following are reported to be the bids opened on Sept. 20 by the Bd. of City Comrs. for the reconstruction of 10th St. sewer: E. G. Trueheart, $6,856, and Galveston Gas Fitting & Plumbing Co., $8,405.

**Ft. Worth, Tex.*—The following are reported to be the bids opened on Sept. 15 for constructing sewers in the 5th, 6th, 7th and 8th wards: R. C. Storrie, New Orleans, La., $96,701; McClintock & Sargeant, La Porte, Tex., $72,473 (awarded contract); J. O. Stevens, Guthrie, Okla. Ter., $87,326; Chas. T. Derr, Guthrie, Okla. Ter., $83,416; J. W. Moore, Lampasas, Tex., $82,286; N. Sherman, Oklahoma City, Okla. Ter., $81,112; American Light & Water Co., Kansas City, Mo., $75,383; E. G. Trueheart, Galveston, $80,428; McQuarters Machine & Pumping Co., Hillsboro, Tex., $72,862.

Orange, Tex.—W. D. Bettis, Secy. Progressive League, writes in regard to the construction of a sewerage system that the city needs such a system, but is not financially able to put it in, and is endeavoring to get in touch with private capital so that a company might be organized for that purpose. He further states that the league feels satisfied that a franchise could be secured from the city. In connection with this a lease can be obtained for the water works, which system could be extended, and in connection with the sewer a company would make a profitable investment. He will furnish any further information on request.

Paris, Tex.—Bids will be received until Oct. 8 by T. C. Bishop, mayor, for the following bonds: $6,500 sewer construction; $50,000, street improvement, and $35,000, public school.

Tacoma, Wash.—It is stated that the estimates of next year will probably contain an item of $50,000 for the construction of a sewer in South Tacoma. Frank L. Davis, City Engr.

Keyser, W. Va.—J. L. Githens, Recorder, writes that the citizens voted Sept. 26 to issue $20,000 bonds for street paving and a sewerage system.

Parkersburg, W. Va.—It is stated that bids will be received until Oct. 11 by the Bd. Affairs for constructing 1,500 ft. 6-ft., 2-ring brick sewer, and 500 ft. 5-ft., 3-ring brick sewer, together with masonry outfall. J. V. Dunbar, City Engr.

New York, N. Y.—The following are the bids opened on Sept. 19 by Louis F. Haffen, Pres. Bronx Boro, for constructing sewers and appurtenances in Clay, Teller, Findlay, College and Morris Aves.: (*a*) Burns & Rodgers, 1909 Amsterdam Ave., $30,437, (*b*) Italian-American Eng. Co., 19 W. 24th St., $37,915, (*c*) W. F. Murray, 1155 Boston Rd., $40,419, (*d*) Briggs & McLaughlin, 19 E 130th St., $33,321 (*e*) Jos. Stanton, 1371 Jerome Ave., $34,348, (*f*) C. W. Collins, Fordham Road and Morris Ave., $32,796, (*g*) Cunningham & Kearns, 432 E. 91st St., $39,060, (*h*) Geo. M. Dunn, 737 E. 171st St., $29,353, (*i*) Clinton Beck with, 29 W. 27th St., $35,105, (*j*) P. F. Brennan, 759 E. 173d St., $41,889, (*k*) S. M. De Pasquale, Williams bridge, N. Y., $33,911.

	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*
500 lin. ft. brick sewer, 26 in. x 36 in.	$8.00	$12.00	$10.00	$10.00	$10.00	$7.00	$10.00	$6.50	$9.00	$12.00	$10.50
1,185 lin. ft. 18-in. pipe sewer	4.00	6.25	5.00	4.00	4.50	4.00	4.50	3.50	3.50	5.00	4.00
1,675 lin. ft. 15-in. pipe sewer	3.50	3.80	4.00	3.00	4.00	3.50	4.25	3.00	3.25	4.00	4.00
2,927 lin. ft. 12-in. pipe sewer	2.20	3.30	3.50	3.00	3.25	3.00	3.75	2.00	2.75	3.50	3.00
745 spurs for house con'ctions	1.00	1.00	1.50	...	.01	.50	.01	.01	1.00	...	1.00
62 manholes	50.00	55.00	65.00	50.00	60.00	45.00	60.00	60.00	75.00	90.00	50.00
18 receiving basins	140.00	170.00	160.00	200.00	180.00	150.00	100.00	168.00	150.00	180.00	200.00
3 catch basins	60.00	75.00	195.00	75.00	100.00	75.00	100.00	50.00	100.00	90.00	200.00
950 cu. yds. rock excav.......	3.00	.01	2.20	3.00	.01	3.50	3.50	3.00	3.50	3.00	.01
100 cu. yds. concrete.........	...	6.00	5.50	...	.01	5.00	4.00	4.00	5.00	...	.01
36 M ft. timber for found...	....	10.00	35.00	...	.01	...	30.00	25.00	20.00	30.00	10.00
25 lin. ft. 12-in. drain pipe..	...	3.00	1.50	...	1.00	...	.01	1.00	1.00	...	1.00

New York, N. Y.—The following are the bids opened on Sept. 19 by Louis F. Haffen, Pres. Bronx Boro. for constructing sewers and appurtenances in W. 176th St. and in Sedgwick Ave.: (*a*) Cunningham & Kearns, 432 E. 91st St., $33,426; (*b*) Culgin & Pace Contr. Co., 177th St. and 3d Ave., $39,806; (*c*) W. F. Murray, 1155 Boston Rd., $39,319; (d) Briggs & McLaughlin, 19 E. 130th St., $32,498; (*e*) Italian American Eng. Co., 19 W. 24th St., $39,180; (*f*) P. F. Brennan, 759 E. 173d St., $39,953; (*g*) Burns & Rodgers, 1909 Amsterdam Ave., $28,856, and (*h*) S. M. De Pasquale, Williamsbridge, $39,556.

Brick sewer—	*a*	*b*	*c*	*d*	*e*	*f*	*g*	*h*
350 lin. ft., 3 ft. 9 in. in diameter..............	$18.00	$35.60	$25.00	$20.00	$30.00	$30.00	$21.00	$25.00
190 lin. ft., 3 ft. 6 in.	13.00	19.15	20.00	15.00	16.00	15.00	10.00	20.00
1,560 lin. ft., 2 ft. 9 in.......................	11.00	10.41	9.99	12.50	11.00	11.00	7.80	10.00
16 lin. ft., 2 ft. 6 in..........................	10.00	10.41	7.99	10.00	10.00	8.00	7.80	10.00
Pipe sewer—								
5 lin. ft., 18-in..............................	4.50	3.76	6.90	4.00	3.50	4.00	2.80	5.00
10 lin. ft., 15-in.............................	4.25	3.76	5.90	3.00	3.00	4.00	2.80	5.00
310 lin. ft., 12-in............................	3.75	3.76	4.90	3.00	2.50	4.00	2.80	4.00
306 spurs for house connections..................	.01	.01	1.90	...	.50	...	.50	1.00
27 manholes	40.00	60.00	69.00	54.00	60.00	90.00	100.00	150.00
25 cu. yds. concrete.............................	4.00	7.50	5.50	4.00	8.00	6.00	...	5.00
25 cu. yds. rubble masonry.......................	4.00	3.75	6.50	4.00	8.00	6.00	...	5.00
350 cu. yds. broken stone........................	2.00	1.50	2.90	1.00	2.00	2.00	...	4.00
55 M ft. timber..................................	30.00	30.00	35.00	...	20.00	35.00	30.00	35.00
9,500 lin. ft. piles	.25	.20	.38	...	.35	.28	.20	.20
100 lin. ft. 12-in. drain pipe...................	1.00	1.00	1.50	...	2.00	...	...	1.00

**Items marked thus give the names of parties awarded contracts.*

Keshena, Wis.—See "Schools."

Salt Lake City, Utah.—Geo. W. Riter, City Engr., writes that it is proposed to construct a large storm water system, and to begin with it is proposed to lay 2,400 ft. of concrete sewer, at a cost of $18,000. No date yet set for the receiving of bids for this work.

Toronto, Ont.—Bids will be received until Oct. 3 by Thos. Urquhart (Mayor) Chmn. Bd. Control, for constructing sewers in portions of Balmoral Ave. and Pearl St.

BRIDGES.

Notes Arranged Alphabetically by States.

**Selma, Ala.*—The County Bd. of Revenue is stated to have awarded the contract for constructing a steel bridge over the Cahaba River at Kirkpatrick's Ferry to the Chattanooga Bridge Co., of Chattanooga, Tenn., for $6,000.

Washington, D. C.—Col. R. Hoxie, Corps Engrs., U. S. A., on Sept. 25, opened bids for constructing a concrete steel bridge in approach to the highway bridge over Potomac River as follows: (*a*) bridge complete with all concrete facing, (*b*) bridge complete with stone facing: Penn Bridge Co., Beaver Falls, Pa., *a* $97,367, *b* $109,500; Ambrose B. Stannard Co., New York, N. Y., *a* $204,000, *b* $226,000; Cranford Paving Co., *a* $126,700; the Monolithic Reinforced Concrete Co., New York, N. Y., *a* $185,000, *b* $198,000; Abbot- Gamble Co., New York, N. Y., *a* $141,000, *b* $150,000; McMullen & McDermott, Washington, D. C., *a* $128,055, *b* $134,555; Jas. A. Hart Co., New York, N. Y., *a* $130,600, *b* $152,000; Miller-Collins Co., New York, *a* $100,000; Crouse Constr. Co., Perth Amboy, N. J., *a* $146,976 and the Bell Eng. & Constr. Co., of New York, N. Y., *a* $154,892.

Pensacola, Fla.—Bids will be received until Jan. 1, 1906 (extension of date) by the Bd. Comrs. of Baldwin Co., Ala., and Escambia Co., Fla., for constructing a steel bridge over Perdido River, near Muscogee, Fla. Address A. M. McMillian, Clk. Bd. Escambia Co. Comrs., Pensacola.

Evansville, Ind.—Bids will be received until Oct. 9 by the Bd. Co. Comrs., for constructing 1 steel and 6 concrete bridges. Harry Stinson, Co. Aud.

Richmond, Ind.—It is reported that bids will be received until Oct. 6 by the Bd. Co. Comrs. (John F. Dynes, Chmn.) for constructing 4 bridges and 1 arch in Franklin and Harrison Townships.

**Indianapolis, Ind.*—The Bd. of County Comrs. is stated to have awarded the contract for constructing a bridge over Eagle Creek in Morrison St. to A. W. Moore & Co., for $20,000.

Williamsport, Ind.—It is reported that bids are wanted until Oct. 20 for $23,000 bridge bonds. R. L. Winks, Co. Aud.

Duluth, Minn.—Bids will be received until Oct. 6 by O. Halden, Co. Aud., for constructing a steel bridge over Talmadge River, on the North Shore Road.

Kansas City, Mo.—Chief Engr. Black, of the Metropolitan St. Ry. Co., is stated to have submitted to Council plans for a tunnel and viaduct, to be paid for jointly by city and company, to be constructed from 12th and Liberty Sts. to Bway and 12th Sts. The total length of both viaduct and tunnel is to be 3,856 ft., divided as follows: viaduct, including 2 approaches, at 12th St. and Bway and 12th and Liberty Sts., 2,182 ft.; tunnel from Lincoln St. to Hasbrook Court, 1,674 ft. The width of tunnel and viaduct throughout will be 60 ft.

Missoula, Mont.—The County Comrs. are stated to have opened on Sept. 20 bids for constructing a bridge over Big Blackfoot River, near Bonner, as follows: O. E. Peppard, of Missoula, several bids ranging from $4,430 to $4,745, and the Western Engineering Co., $5,200.

Plainfield, N. J.—Bids are reported to have been opened Sept. 19 by the Union and Somerset County Boards of Freeholders for constructing a bridge over Greenbrook on West End Ave., as follows: For the superstructure work: Wm. T. Kirk, $5,690; Bogart Corlough Co., $6,333; Swears Sutton Co., $5,735; Owego Bridge Co., $5,750; Canton Iron Bridge Co., $5,950; Wm. Farrier, concrete abutments, $5.75 per cu. ft.; about 430 cu. ft. required; sidewalks, brick arches, etc., $1,685; catch basins, $75 each. Jos. Kingston, for the concrete abutments, $5.75 per cu. ft., and $1,872 for the sidewalks, brick arches and $71.25 each for catch basins.

Kearny, N. J.—The Joint Com. on Free Bridges of the Essex and Hudson County Boards of Freeholders is stated to have decided to build a bridge over the Passaic River at Clay St. The bridge will have a draw of the rolling lift type, and the structure will cost about $125,000. James Owen, Engr. of the Essex County Bd. of Freeholders, at Newark, is reported to be preparing the plans.

Ashland, O.—It is stated that bids will be received until Oct. 14 by E. B. Westover, Co. Aud., for constructing the superstructure of a steel bridge across Black Fork in Green Township, 110 ft. extreme; also for constructing the substructure and approaches of said bridge.

Cleveland, O.—It is stated that the Cleveland Short Line will construct a viaduct over the Cuyahoga River, Ohio Canal, and the B. & O. tracks from Newburg Heights to Brooklyn Heights. The structure to be 165 ft. high, about 2,640 ft. long, with masonry piers and steel towers, estimated cost $1,000,000.

Dayton, O.—Bridge bonds amounting to $25,000 are reported sold.

**Turtle Creek, Pa.*—The contract for constructing a bridge over Thompson's Run is stated to have been awarded by the County Comrs. on Sept. 6 as follows: Superstructure, Penn Bridge Co., of Beaver Falls, for $4,388; masonry work, to Frederick Wilsman, Sr., for $4,500.

**Ft. Pierre, S. D.*—The contract for constructing a bridge, containing a steel span 260 ft. over Bad River, is reported to have been re-awarded to A. Y. Bayne & Co., of Minneapolis, Minn., for $8,492.

Nashville, Tenn.—The Co. Comrs. are reported to have under consideration the construction of two bridges across Cumberland River, in Nashville.

**Portage, Wis.*—The following are the bids opened on Sept. 20 by the City Council for the construction of a highway bridge across Wisconsin River, at Portage, consisting of 3 concrete piers and 2 concrete abutments: Schillinger Bros. & Co., Chicago, Ill., $13,332 (awarded contract); Milwaukee Bridge Co., Milwaukee, $15,850; Wm. S. Hewitt & Co., Minneapolis, Minn., $16,344.

L. P. Wolff, Consulting Engr., St. Paul, Minn. is preparing plans for the superstructure for the above bridge, which will consist of 4 spans of 160 ft. each, with 24-ft. paved roadway and one 6-ft. sidewalk. Bids for this part of the work will be opened about Nov. 1.

**London, Ont.*—A. E. Welch, of London, Mgr. Southwestern Traction Co., writes that the Hamilton Bridge Co., of Hamilton, Ont., has secured the contract for constructing a steel bridge east of Richmond St., in London, for $15,000; also for one at St. Thomas, Ont., for $8,000.

PAVING AND ROADMAKING.

Notes Arranged Alphabetically by States.

Birmingham, Ala.—J. C. Murray, City Clk., writes that it is proposed to pave 5th Ave. from 14th to 19th St. with bituminous macadam; probable cost, $22,000.

**Oakland, Cal.*—The Bd. of Pub. Wks. is stated to have awarded the contract for improving a portion of Harrison Boule. to the Piedmont Paving Co., Macdonough Bldg., for $5,011.

Redding, Cal.—See "Sewerage and Sewage Disposal."

Wilmington, Del.—The Levy Court is stated to have rejected all bids received Sept. 19 for constructing a macadam road in New Castle County. According to reports new bids will be received.

Ft. Oglethorpe, Ga.—Bids will be received until Oct. 16 by Capt. C. Nixon, Constr. Q. M., for paving driveways in 9 stables with vitrified brick, installing 14 double iron gates in corral fences and repairing corral fences, as advertised in The Engineering Record.

Kangley, Ill.—It is stated that bids will be received until Oct. 3 by the Comrs. of Highways, for constructing a gravel road.

Chicago, Ill.—Bids will be received until Oct. 3 by the Bd. Local Improv. (And. M. Lynch, Pres.) for grading and paving a portion of Berkeley Ave. with limestone.

Kankakee Ill.—The Bd. Local Improv. is stated to have opened on Sept. 8 the following bids for paving: *a* Hickory, 1st, 2d and 3d Sts. and *b* Utica St.: J. Cape & Sons, of Racine, Wis., *a* $17,522, *b* $6,849; M. Foley, of Evanston, *a* $17,961, *b* $6,976; Smith & Brown, of Chicago, *a* $19,329, *b* $7,045, and John W. Barker, Evanston, *a* $18,745, *b* $7,648.

**Hoopeston, Ill.*—The Bd. Local Improv. is stated to have awarded the contract for paving with brick a portion of Washington St., at $1.33½ per sq. yd.

**Peoria, Ill.*—The Barber Asphalt Paving Co., Chicago, is stated to have received the contract for paving about 5,251 sq. yds. on Perry Ave. and 4,300 sq. yds. on High St. at $6,323 and $5,138 respectively.

Evanston, Ill.—The Council has passed ordinances for paving a number of streets, but work will not be ready for letting before the spring of 1906.

**Vincennes, Ind.*—The contract for constructing 2 miles of gravel road in Washington Township is stated to have been awarded to Brocksmith & Ashley, for $68,080.

**Martinsville, Ind.*—The Comrs. of Morgan County are stated to have awarded contracts for constructing rock roads in Ashland Township to Pickens & Larkins and W. J. Smith for $3,080 and $3,965 respectively.

**Indianapolis, Ind.*—A contract for the construction and improvement of the Pleasant Run Boule. is stated to have been awarded by the Park Bd. (bids opened Sept. 22) to J. D. Hoss for $24,995. The roadway to be paved with bitulithic and cement sidewalks laid.

**Brazil, Ind.*—The contract for constructing the Jack Loveall Free Gravel Road in Dists. Johnson and Van Buren Townships is reported to have been awarded by the Bd. Co. Comrs. on Sept. 14 to Campbell-Crabb for $5,100.

Marion, Ind.—The Comrs. of Grant and Huntington Counties are stated to have opened bids as follows for constructing the Holmes gravel road: Nathan P. Modlin, $8,500; Modlin & Overman, $7,700; Oren J. Simmons, $8,270; L. A. and D. F. Shutt, $7,484; Frankfort Constr. Co., $9,480 and Abraham Garr, $7,470.

**Bluffton, Ind.*—The Hoosier Constr. Co., of Indianapolis, is stated to have received the contract for paving with asphalt a portion of Cherry St. at $2.05 per sq. yd.

**Terre Haute, Ind.*—The Bd. of Pub. Wks. is stated to have opened on Sept. 8 the following bids for paving portions of (*a*) Ohio St. and (*b*) Locust St.: Grant-Forbes Co., *a* $4,100, *b* $39,900; Roberts & Co., *a* $3,900, *b* $38,900; Voorhees & Son, *a* $3,500 (awarded contract), *b* $38,000; Jesse Robertson, *a* $4,896, *b* $43,730; Fred C. Meredith, *b* $35,000 (awarded contract).

**Iowa City, Ia.*—T. L. Crowley, of Iowa City, has secured the contract for paving with brick the following streets: Capitol St., 2,223 sq. yds. on old stone foundation 6-in. thick, $1.14, and for 5,788 sq. yds. on new macadam foundation 6-in. thick, $1.26. College St., 2,400 sq. yds. on 6-in. concrete foundation, $1.53, and Court St., 2,475 sq. yds. on 5-in. concrete foundation, $1.45; earth excav., 30 cts., 33 cts. and 28 cts., respectively; sandstone curb, 55 cts. and 48 cts. per lin. ft.; total cost of the 3 streets, $20,585. The totals of the other bids received were: John L. Berry, Iowa City, $23,144; Wm. Horrabin, Iowa City, $22,084, and M. Ford, Cedar Rapids, $23,293. Chas. S. Magowan, City Engr.

Atlantic, Ia.—It is stated that bids will be received until Oct. 3 by John J. Rapp, City Clk., for constructing sidewalks on several streets.

Des Moines, Ia.—The following are the bids opened by the Bd. of Pub. Wks. (W. W. Wise, Chmn.) on Sept. 14 for furnishing 100,000 repressed paving brick (price given per M.): Barber Asphalt Paving Co., Des Moines, $13, and Jas. Horrabin & Co., of Des Moines, $13.25.

Ft. Des Moines, Ia.—Bids will be received until Oct. 4 by Capt. L. Hardeman, Constr., Q. M., for macadam road and woven wire fence for post cemetery at Ft. Des Moines.

**Iola, Kan.*—The contract for paving with brick about 13,477 sq. yd. on South St. is reported to have been awarded to F. P. Delone & Co., at $1.31 per sq. yd.

Geo. Myers, City Engr., writes that bids are wanted Oct. 5 for paving Washington Ave. with brick on a cinder foundation, sand filler; probable cost of work, $20,000.

**Louisville, Ky.*—The contract for paving with asphalt on a portion of Gray St. is reported to have been awarded by the Bd. Pub. Wks. to the Barber Asphalt Paving Co., 347 5th Ave., at $1.34 per sq. yd.

**Boston, Mass.*—Contracts for constructing sections of state highway (bids opened Sept. 21) have been awarded as follows: West Newbury Road, to T. F. O'Neil, Newburyport, for $6,035; Kingston Road, to Lane Quarry Co., Hingham, $3,870; Groveland Road, to Jas. E. Watkins, Amesbury, $2,927; Palmer Road, to Rowe & Perinni, South Framingham, $6,591; Wareham and Beverly Roads, to Fred E. Ellis, Melrose, $8,291, and Douglass Road, to Chas. E. Horne, Millbury, $3,904.

* Bids will be received until Oct. 5 by the Boston Rapid Transit Comn. (B. Leighton Beal, Secy.) for repaving a portion of State St.

Grand Rapids, Mich.—The City Engr. is stated to have estimated the cost of paving as follows: Grading and graveling with combination curb and gutters a portion of Horton Ave., $37,240, and grading and paving a portion of E. Bridge St. with Medina block and asphalt, $30,520.

St. Paul, Minn.—The following bids are stated to have been opened on Sept. 13 by the Bd. Pub. Wks. for paving a portion of Fillmore Ave. (*a*) brick, (*b*) granite; (*c*) creosoted wooden block, (*d*) sandstone: Jas. Forrestal Co., *a* $6,489, *b* $8,440, *c* $8,841, *d* $8,486, and Fielding & Shepley, *a* $6,993, *c* $9,100, *d* $8,500.

**Marysville, Mo.*—J. C. Likes, of Des Moines, Ia., is stated to have received the contract for paving here, for $50,000.

Concord, N. H.—Bids will be received until Oct. 4 by A. W. Dean, State Engr., for improving portions of roads in 7 towns; also Oct. 7 in 9 towns.

Jersey City, N. J.—Bids will be received until Oct. 2 by the Street and Water Comrs. (Geo. T. Bonton, Clk.) for paving and repaving portions of 6 streets. In all about 2,120 sq. yds. asphalt pavt.; 5,094 sq. yds. Belgian blk.; 13,200 sq. yds. on concrete base, including excav.; 1,375 ft. curb., 5x16 in., set in concrete, etc.

Trenton, N. J.—Bids will be received until Oct. 3 by the Common Council for paving a portion of N. Stockton St. with sheet asphaltum. Harry B. Salter, City Clk.

Paterson, N. J.—Bids will be received until Oct. 2 by the Dept. Streets and Sewers for paving with asphalt portions of River, Smith and Putnam Sts. Robt. Dalzell, City Street Comr.

Ft. Hancock, N. J.—Bids will be received until Oct. 16 by Abe S. Bickham, Q. M., U. S. A., for constructing macadam roadways and concrete sidewalks here.

New York, N. Y.—The lowest bid opened Sept. 19 by Louis F. Haffen, Pres. Bronx Boro., for paving Dawson St. was submitted by the Interstate Paving Co., as follows: 5,700 sq. yd. asphalt block, $1.40; 870 cu. yd. concrete, $4.30; 2,050 lin. ft. new curb, 90 cts., and 100 lin. ft. old curb, 30 cts.; total, $13,596. The other bids received were: Hastings Pav't Co., $13,695; Asphalt Contr. Co., $15,651; Continental Asphalt Pav't Co., $13,654; Barber Asphalt Pav't Co., $14,362.

The following bids were opened by Louis F. Haffen, Pres. Bronx Boro., on Sept. 19:

For repaving E. 150th St. (*a*) 3,000 lin. ft. new curb; (*b*) 3,950 sq. yd. Medina stone block; (*c*) 685 cu. yd. concrete; (*d*) total: Cunningham & Kearns, *a* 80 cts., *b* $2.94, *c* $4, *d* $16,807; F. V. Smith Contr. Co., *a* 80 cts., *b* $3, *c* $4, *d* $17,044.

*The following are the bids opened Sept. 22 by the Dept. of Docks and Ferries for paving Piers 57 and 58, North River, with asphalt, in all 26,000 sq. yd.: Sicilian Asphalt Paving Co., Times Bldg., 98 cts. per sq. yd.; Uvalde Asphalt Paving Co., 1 Bway, 85 cts.; total cost, $21,900 (awarded contract); Barber Asphalt Paving Co., 114 Liberty St., 92¼ cts.

The lowest bid received by Louis F. Haffen, Pres. Bronx Boro., for regulating, etc., and building steps in Belmont St. from Clay Ave. to Topping Ave., was submitted by Gallo & Pittelli, 127 Mulberry St., for $7,154.

Bids will be received until Oct. 7 by Louis F. Haffen, Pres. Boro. Bronx, for curbing, paving and repaving portions of White Plains Road and Dawson St. Engineer's estimate: 115,700 sq. yds. completed asphalt block pavt., and keeping the same in repair for 5 years from date of acceptance; 16,870 cu. yds. concrete, including mortar bed; 2,050 lin. ft. new curb, furnished and set in concrete; 31,700 lin. ft. old curb, reset in concrete.

For repaving E. 161st St. and Elton Ave. with 1,800 sq. yd. asphalt, 2,370 sq. yd. granite block, 900 lin. ft. new flag, etc.: Cunningham & Kearns, $12,212; M. Baird Contr. Co., $11,780; F. V. Smith Contr. Co., $12,195; Uvalde Asphalt Pav't Co., $12,835; Asphalt Constr. Co., $11,885.

For repaving E. 144th St. from 3d Ave. to Rider St. with asphalt block, the Continental Asphalt Paving Co. bid $8,295 and the Barber Asphalt Co. $7,658.

For reconstructing steps, etc., at W. 177th St. from Sedgwick Ave. to Cedar Ave.: Harduven-Schloss Contr. Co., $8,773; Cunningham & Kearns, $7,853; Gallo & Pettelli, $7,146, and M. J. Leahy, $9,799.

New York, N. Y.—The following are the bids opened Sept. 19 by Louis F. Haffen, Pres. Bronx Boro., for paving White Plains Road with asphalt block from Morris St. to the City Line: (*a*) Barber Asphalt Paving Co., $233,884, (*b*) Asphalt Constr. Co., $255,020, (*c*) Interstate Paving Co., $223,620, (*d*) Hastings Paving Co., $225,408:

	a	*b*	*c*	*d*
16,000 cu. yds. concrete....	$3.96	$4.75	$4.30	$4.00
110,000 sq. yds. asph. blks.	1.51	1.57	1.35	1.43
31,600 lin. ft. old curb......	.14	.20	.20	.13

Brooklyn, N. Y.—Bids will be received until Oct. 11 by Martin W. Littleton, Boro. Pres., for regulating, repaving and constructing cement sidewalks on portions of several streets. Engineer's estimate: 8,690 sq. yds. as-

Items marked thus give the names of parties awarded contracts.

phalt pavt.; 6,210 sq. yds. granite blk. pavt., with tar and gravel joints; 6,430 lin. ft. new curb; 24,800 sq. ft. cement concrete sidewalk; 2,640 cu. yds concrete; 557 sq. ft. new granite bridge stone; 22 noiseless covers and heads for sewer manholes, etc.

Tuckahoe N. Y.—Bids will be received until Oct. 3 by the Bd. Village Trus. for furnishing material regulating, grading and otherwise improving Breckenridge St., as advertised in The Engineering Record.

Cleveland, O.—The following are the bids opened on Sept. 18 for paving Detroit St. (*a*) Standard Paving Co., $23,952; (*b*) North Ohio Paving & Constr. Co., $22,959; (*c*) John F. Brennan, $24,000:

	a	*b*	*c*
2,500 cu. yd. excav.	$0.55	$0.40	$0.50
12,750 sq. ft. dressed block Medina pav't	.34	.34	.34½
9,000 sq. ft. dressed block Medina pav't, relaid	.13	.10	.12
35,100 sq. ft. concrete found'n laid.	.07	.07½	.08
45,700 sq. ft. brick pav't.	.17	.16½	.16¼
12,000 sq. ft. brick pav't relaid.	.10	.10	.10
3,500 lin. ft. 5-in. Medina curb.	.75	.70	.75
7 new catch basins.	40.00	40.00	45.00
150 lin. ft. 12-in. catch basin pipe.	.75	1.00	1.00
16,000 sq. ft. new flagging.	.16	.15	.16

The following are the bids opened on Sept. 18 for paving Willson Ave.: The Standard Paving Co. bid for 1,000 cu. yds. excav., 49 cts.; 3,400 sq. ft. dressed block Medina pav't, 34 cts.; 30,000 sq. ft. of same, relaid, 13 cts.; 10,000 sq. ft. concrete walk, 25 cts.; 11,000 sq. ft. brick pav't, laid, 16 cts., and 1,000 lin. ft. 5-in. Medina curb, 75 cts.; total cost, $11,824; John F. Brennan, $14,129, and the North Ohio Paving & Constr. Co., $13,636.

Cleveland, O.—Bids will be received until Oct. 4 by the Bd. Public Service (A. R. Callow, Secy.) for grading, curbing and paving with 5-in. paving brick a portion of Aberdeen St.

Springfield, O.—The following bids are reported to have been opened by the Bd. Pub. Service for paving portions of several alleys, *a* brick, *b* limestone curb, *c* protection curb, *d* resetting manholes, *e* resetting valve boxes, *f* repairing brick paving, *g* rounded limestone curb; W. F. Payne, *a* $1.65 per sq. yd., *b* 60 cts., *c* 30 cts., *d* $2, *e* $5, *f* $2.50, *g* 98 cts.; Dan'l. Doyle *a* (2 bids) $1.60 and $1.58 per sq. yd., *b* 57 cts., *c* 35 cts., *d* $4, *e* $4, *f* $2.50, *g* $1.50; Chas. Bird, *a* (5 bids) $1.55 to $1.74, *b* 65 cts., *c* 40 cts., *g* $1.25, and Springfield Paving Co., *a* several bids ranging from $1.49 to $1.85, *c* 25 cts., *f* $3.

Bids will be received by the Bd. Pub. Service (Chas. C. Bauer, Clk.) for furnishing material, grading, graveling and constructing cement combined curbing and gutters on portions of Bway., Grant and Factory Sts.; also grading and macadamizing portions of Fremont Ave. and Catherine St.

**Toledo, O.*—Kerlin Bros., 410 Nasby Bldg., are stated to have received the contract for paving with Logan brick on a portion of Woodland Ave., for $15,000.

Norwalk, O.—The following bids are reported to have been opened by the Bd. Pub. Service for paving Garden St.: Enterprise Paving & Constr. Co., (3 bids) $4,153 to $4,370; Ohio Engineering Co. (3 bids) $3,578 to $3,875; Geo. S. Stewart, $4,087; Otis & Ferguson (2 bids) $4,674 and $4,728; W. A. Hadley, $3,382; Easton & Quinn, $4,502; Frank Reiley (3 bids) $4,671 to $4,833, and Townsend Brick & Clay Co., $1,674.

Cincinnati, O.—Bids will be received until Oct. 18 by the Bd. Pub. Service (Geo. F. Holmes, Clk.) for improving a portion of Bauer Ave. by grading, curbing and paving with asphalt, etc.; also same date, a portion of Warsaw Ave., with bitulithic.

Bids will be received until Oct. 16 at the office of W. T. Perkins, City Auditor, for $250,000 street improvement bonds.

Bids will be received until Oct. 6 by the Bd. Pub. Service (Geo. F. Holmes, Clk.) for furnishing materials and improving a portion of Baum St., by grading, curbing and bouldering the roadway.

Bids will be received until Oct. 9 by the Bd. Pub. Service (Geo. F. Holmes, Clk.) for improving a portion of Monastery St., by grading curbing bouldering the roadway and constructing necessary retaining walls; also Oct. 23 a portion of Innes Ave. by grading, curbing and paving with asphalt.

**Bellevue, O.*—Baldwin Bros. & Graham, of Cleveland, are stated to have received the contract for paving S. West St., for about $9,550.

**East Palestine, O.*—The contract for paving Main St. with vitrified block (bids opened Sept. 5) is stated to have been awarded to John C. Devine, of Alliance, for about $25,700.

Findlay, O.—It is reported that bids will be received until Oct. 12 by Wm. Demland, City Aud., for $4,035 Liberty St. paving bonds.

Ashland, O.—It is reported that bids will be received until Oct. 16 by M. H. Kagey, for $10,500 Sandusky St. improvement bonds.

Fremont, O.—Bids will be received until Oct. 17 by the Finance Com. (L. A. Dickinson, Chmn.) for $30,000 W. State St. paving bonds.

Columbus, O.—Bids will be received until Oct. 5 by the Bd. Pub. Service (Chas. H. Frank, Secy.)) for curbing and paving with asphalt a portion of Space St.; also a portion of Spruce St. with hard-burned brick or block.

Bids will be received by the Bd. Trus., Columbus Pub. Library until Oct. 24 (John J. Pugh, Secy.) for retaining walls, curbs, roadways, etc.

Norwood, O.—Bids will be received by the Bd. Pub. Service (J. E. Thorpe, Clk.) until Oct. 14 for furnishing materials, grading, macadamizing and graveling a portion of Marsh Ave. J. A. Stewart, City Engr., 813 Traction Bldg., Cincinnati,

Bowling Green, O.—Bids will be received until Oct. 9 by the Bd. Co. Comrs. for $100,000 highway improvement bonds.

Harrisburg, Pa.—The following bids are stated to have been received Sept. 11 by the Highway Comr. for paving *a* with asphalt, *b* granite curbing, *c* granolithic, *d* Reese & Hammond block: Barber Asphalt Paving Co., *a* $1.79, *b* 94 cts., *c* 57 cts. for Riley and 4th Sts.; Warner Quinlan Co., *a* $1.98, *b* $1.05, *c* 70 cts. for Riley St., *a* $1.85, *b* $1.05, *c* 70 cts. for 4th St.; G. B. Stucker, *d* $1.90, *b* $1.07 *c* 80 cts. for Reily St., *d* $1.85, *b* 98 cts., *c* 80 cts. for 4th St. The improvement will require 10,800 sq. yds. paving and 6,620 ft. of curb.

Doylestown, Pa.—Bids will be received until Oct. 18 by the State Highway Dept., Harrisburg (Jos. W. Hunter, Comr.), for reconstructing 27,700 ft. road in Falls Township, Bucks Co.

Franklin, Pa.—Bids will be received until Oct. 18 by Comr.), for constructing 16,242 ft. road, extending from end of present State road through Seneca to Salina; also 4,530 ft. brick paving in Cranberry Township, Venango County.

Philadelphia, Pa.—Common Council has passed the bill to submit to the people at the November election the question of creating a loan of $2,000 to repave unimproved streets.

Greensburg, Pa.—Bids will be received until Oct. 4 by the State Highway Dept. (Jos. W. Hunter, Comr.), Harrisburg, for reconstructing 1,542 ft. road in Loyalhanna Township, Westmoreland Co.

Hollidaysburg, Pa.—Bids will be received until Oct. 11 by the State Highway Dept. Harrisburg (Jos. W. Hunter, Comr.) for constructing 22,200 ft. road in Greenfield Township, Blair Co.

Cheswick, Pa.—It is stated that bids will be received until Oct. 5 by W. M. Straub, Boro. Secy., for widening and grading Freeport Road, approximately 10,000 cu. yds. of earth to be excav.

**Wilkesbarre, Pa.*—The Warner-Quinlan Co., 32 Bway, New York, N. Y., is stated to have received the contract for repairing streets at $6 per sq. yd. for concrete, $9 per sq. yd. for binder and $1.40 per sq. yd. for asphalt.

Washington, Pa.—The Boro. Council is stated to have passed an ordinance providing for the paving of McAdam Ave.

El Paso, Tex.—Pery McGhee, City Clk., writes that the city contemplates putting down $175,000 of street paving as soon as necessary preliminaries can be arranged. The issue of bonds to pay for this improvement has been authorized by City Council, and bids for bonds will soon be received. When bonds are sold plans and specifications will be prepared. Geo. C. Wimberly, City Engr.

Paris, Tex.—See "Sewerage and Sewage Disposal."

Dallas, Tex.—It is stated that the City Engr. will soon receive bids for paving Bryan St.

Spokane, Wash.—The following bids are reported to have been opened by the Bd. of Pub. Wks. on Sept. 14 for grading, curbing, parking and constructing sidewalks on a portion of 6th Ave.: R. A. Hutchinson, $5,390; Peter Costello, $5,300; John H. Fife, $4,970; J. A. Lynch, $4,849, and August Ilse, $4,750.

Keyser, W. Va.—See "Sewerage and Sewage Disposal."

**Seattle, Wash.*—Dow & Co., of Seattle, have secured the contract for grading and concrete sidewalks on East Fir and other streets at the following bid: Fixed estimate, $900; 7.9 acres clearing and grubbing, $100; 30,000 cu. yd. earthwork, 23½ cts.; 21 M. ft. crosswalks, $14; 81 M. ft. curbs, gutters, etc., $14; 7,145 sq. yd. concrete sidewalks, $1; 3 catch basins, double inlets, each, $75; 13 catch basins, single inlets, each, $60; 1 catch basin, 3 inlets, $87; 3 catch basins to be moved, each, $60; 4 single inlets, each, $35; 2,430 lin. ft. 3-in. sewer pipe, 10 cts.; 108 lin. ft. 8-in. pipe sewer, $1.20; total cost, $19,098.

The totals of the other bids received were as follows: T. Ryan, $20,870; Frank & Brandon, $20,368; Andrew Peterson, $19,900, and Hans Pederson, $20,738. Bidders all of Seattle.

Superior, Wis.—Bids will probably be received some time this winter for the paving of N. 7th St., at a cost of $18,000. Howard Thomas, City Engr.

Toronto, Ont.—Bids will be received until Oct. 3 by **Thos. Urquhart (Mayor), Chmn. Bd. Control, for paving** portions of several streets with asphalt, bitulithic, tar macadam and concrete; also constructing concrete sidewalks on portions of numerous streets.

*The contract for constructing a macadam roadway on a portion of Dufferin St. is reported to have been awarded to Godson & Co., for $10,887.

The Legislative Com. is reported to have favorably recommended to Council the by-law providing for a speedway on east bank of the Don.

*J. F. Connolly is stated to have received the contract for paving with vitrified brick blocks on Dovercourt Rd., for $14,588.

New York, N. Y.—The following are the bids opened Sept. 19 by Louis F. Haffen, Pres. Bronx Boro., for regulating, etc., Grant Ave. from E. 165th St. to E. 170th St. (*a*) Uvalde Asphalt Paving Co., $48,535, (*b*) D. W. Moran, $49,360, (*c*) A. B. Vermilye, $62,238, (*d*) McCabe, Holland & Co., $51,746, (*e*) Cunningham & Kearns, $47,541, (*f*) C. W. Collins, $67,583.

	a	*b*	*c*	*d*	*e*	*f*
1,050 cu. yds. excav.	$.70	$.71	$.01	$1.00	$.75	$1.00
124,600 cu. yds. fill.	.28	.29	.05	.30	.27	.43
6,460 lin. ft. new curb.	.75	.73	1.50	.80	.80	.80
25,630 sq. ft. new flag.	.25	.23	1.74	.26	.25	.25
1,560 sq. ft. new bridgestone.	.50	.50	.60	.50	.60	.50
300 cu. yds. dry rubble masonry.	2.00	2.00	2.00	1.25	2.00	2.00
7,000 M. ft. lumber.	40.00	70.00	25.00	47.00	.01	...

New York, N. Y.—The following are the bids opened Sept. 19 by Louis F. Haffen, Pres. Bronx Boro., for regulating, etc., Morris St. from White Plains Road to Boston Road: (*a*) Troy Public Wks. Co., $56,856, (*b*) Carmin Cipolla & Co., $44,825, (*c*) D. W. Moran, $48.689, (*d*) P. J. Duffy, $49,490, (*e*) G. I. Bailey, $54,121.

	a	*b*	*c*	*d*	*e*
7,600 cu. yds. earth excav.	$.01	$.50	$.08	$.40	$1.00
500 cu. yds. rock excav.	2.00	2.00	2.00	1.50	1.30
46,200 cu. yds. fill.	.75	.45	52.00	.60	.53
6,100 lin. ft. new curb.	.80	.85	.77	.90	.90
22,000 sq. ft. new flag.	.25	.25	.27	.28	.27
4,200 sq. ft. new bridgestone.	.60	.60	.55	.60	.60
400 cu. yds. dry rubble masonry.	2.00	1.50	2.00	2.00	1.75
100 cu. yds. rubble in mortar.	4.00	4.00	4.00	5.00	4.50
500 lin. ft. 12-in. vitr. pipe.	2.00	2.00	4.00	1.00	2.50
1,000 lin. ft. 24-in. vitr. pipe.	5.00	4.00	6.85	2.00	5.00
1,000 M. ft. lumber.	30.00	30.00	60.00	10.00	35.00

POWER PLANTS. GAS AND ELECTRICITY.

Notes Arranged Alphabetically by States.

Mena, Ark.—The Mena Light, Heat & Power Co. has been incorporated with a capital of $250,000, to own and operate a heating and lighting plant, in addition to cold storage and other utilities. Incorporators: Francis R. Hoyt, Willston D. Hoyt, and others.

Sacramento, Cal.—E. J. Carragher, it is reported, is clerk of a Com. appointed to find ways and means of establishing a municipal lighting plant.

Denver, Colo.—It is stated that improvements costing nearly $1,000,000 are to be made by the Denver Gas & Electric Co. to its plant during the coming year. Next spring in the plant at 6th and Lawrence Sts. a new Curtiss 3,000-kw. generating turbine, costing $150,000, is to be installed. Later on in the year a similar turbine is to be installed in this plant. New machinery, costing abut $150,000, to replace wornout machinery, is to be purchased by the company. The building is to be enlarged at a cost of about $45,000. Four 500-h.p. boilers working under a pressure of 150 lbs. steam pressure are to be installed. The gas manufacturing plant at 7th and Wewatta Sts. is to be improved. A storage tank, having a capacity of from 3,000,000 to 5,000,000 cu. ft. of gas will be erected beside the present tank, the cost to be about $250,000. Eight new gas furnaces are to be installed in the gas plant next month, each to cost about $20,000. A water gas machine is to be installed this fall, to generate from 1,500,000 to 2,000,000 cu. ft. and to cost about $50,000. Purifiers and condensers for the gas plant will also be installed next month, and with the additions to the buildings required to cover them, the cost will be about $60,000.

Hartford, Conn.—The Helena Light & Ry. Co., it is stated, has been organized with a capital of $1,000. Lewis Sperry, of South Windsor, Pres., and Warren B. Johnson, of Enfield, Secy. & Treas.

Washington, D. C.—Bids will be received at the Bureau Supplies and Accounts, Navy Dept., Washington, until Oct. 10 to furnish at the navy yards, Portsmouth, N. H., Boston, Mass., New York, N. Y., League Island, Pa., Washington, D. C., and Norfolk, Va., a quantity of naval supplies, as follows: Dynamotors; motors; conduit; testing sets, electrical supplies; rheostats; Portland cement; iron ventilators; copper pipe; pipe fittings; valves; block and tool steel, etc.; also Oct. 17 at the navy yards, Mare Island, Cal., and Puget Sound, Wash., as follows: Motor; electric wire and fittings; conduit cable; motor drive outfit; electric traveling hoist; air hoist; steam separator; windlasses, etc.; also Oct. 31 at the navy yards, Mare Island, Cal., and Puget Sound, Wash., the following: Motors; wattmeters; electric traveling crane; electric traveling hoists; pumps; steel; copper; iron; pipe; valves, etc. H. T. B. Harris, Paymaster-Gen., U. S. N.

Washington, D. C.—Bids will be received at the office of Elliott Woods, Supt. U. S. Capitol Bdg. and Grounds, until Nov. 8 for electric lighting fixtures for the U. S. Capitol, as advertised in The Engineering Record.

Savannah, Ga.—The Savannah Lighting Co. has formally accepted the lighting franchise granted it by special ordinance of Council, passed Aug. 18. J. J. Cumming, Pres. of the company, is reported to be expecting here a representative of the American Conduit Co., to make estimates on the underground work, although there is also a report that the conduits of the Georgia Telephone Co. may be used.

Cochran, Ga.—Arthur Pew, Temple Court, Atlanta, has been selected to prepare plans for an electric light plant and improvements to the water works; probable cost, $17,000.

Bids for the purchase of $17,000 electric light and water bonds are wanted at once. Address Dr. T. D. Walker, Chmn. Bond Comrs.

Lewiston, Idaho.—The Clearwater Irrigation, Land & Boom Co. has been incorporated, with a capital of $150,000, by H. L. Pittock and F. W. Leadbetter, of Portland, Ore., and L. A. Porter, of Lewiston, to develop electric power from Clearwater River.

The Lewiston Gas Co. is reported to have decided to make improvements to its plant.

Breese, Ill.—The Breese Water & Light Co. is preparing to install a central lighting plant, and will receive bids on the entire equipment until Oct. 9. Engineer, Wm. H. Bryan, Lincoln Trust Bldg., St. Louis, Mo.

Chicago, Ill.—Bids will be received until Oct. 23 by the Co. Comrs. for the purchase of the electric light plant at the County Hospital, to consist of 2 ideal engines, 125 h.p. ea., and 4 national electric direct-current dynamos, 35 k.w. ea. Wm. McLaren, Supt. Pub. Service, Rm. 319, 218 La Salle St.

Freeburg, Ill.—Plans and specifications have been completed by Owen Ford, 710 Security Bldg., St. Louis, Mo., for the proposed municipal electric light and power plant, to cost about $9,000. Chas. Kessler, Village Clk.

Valparaiso, Ind.—The Valparaiso Lighting Co. is reported incorporated, with a capital of $150,000, to construct a new plant for light, heat and power. Directors: C. H. Geist, C. B. Kelsey and Edw. Clifford.

**Crawfordsville, Ind.*—J. F. Davies, of Toledo, O., is stated to have secured the contract for repairing the city electric light plant for $7,433.

Shelbyville, Ind.—C. F. Street is reported to have purchased the plant of the Shelbyville Water & Light Co., and is stated that it will be improved. F. M. Nichols, of Shelbyville, Supt.

Items marked thus give the names of parties awarded contracts.

Wynnewood, Ind. Ter.—It is stated that an election will probably be held the latter part of October, to vote on issuing bonds for the construction of water works and an electric light plant, probable cost $40,000.

Mt. Ayr, Ia.—It is stated that M. N. Hamilton, of Osceola, and others, contemplate establishing a gas plant.

**Marshalltown, Ia.*—The General Electric Co., of Schenectady, N. Y., is reported to have secured the contract for a new dynamo for the city light plant at $3,100.

Covington, Ky.—Thos. Jenkins, representing the National Constr. Supply Co., of St. Louis, Mo., is stated to have submitted to the Light Committee of General Council, a proposition to install an electric light plant with duplicate machinery of sufficient capacity to supply 400-arc lights of 2,000 c.p., and 2,000 incandescent lights for $75,000.

Baltimore, Md.—Bids will be received until Oct. 4 by the Bd. of Awards (E. Clay Timanus, Pres.) for furnishing for the use of the City of Baltimore underground cables, and for the use of the Electrical Comn., special duct pipe. Chas. E. Phelps, Jr., Ch. Engr.

The following are the bids opened on Sept. 27 by the Superv. Archt. Treas. Dept., Washington, D. C., for the installation complete of the conduit and electric wiring system for the U. S. Custom House at Baltimore: L. K. Comstock Co., New York, N. Y., $16,495; C. F. Brown, New York, N. Y., $15,994; Keller, Pike & Co., Philadelphia, Pa., $15,477; T. W. Bryan & Co., Baltimore, Md., $16,206, and Peet McAnerney & Powers, New York, N. Y., $12,437.

Midland, Md.—J. C. Brydon, Supt. of the Consolidated Coal Co., it is stated, will erect a plant at Ocean Mine No. 1, with power enough to supply light to the town of Midland and surrounding places.

L'Anse, Mich.—The plans of Liebert & Macneil, of Calumet, are stated to have been accepted for the municipal electric light plant; probable cost, $10,000.

Alma, Mich.—H. G. Bedford, of Grand Rapids, and J. W. Robinson, of Alma, are reported to have secured a franchise for a gas plant.

Edina, Mo.—The Edina Light Co., it is reported, has been incorporated with a capital of $10,000. Incorporators: Fred. J. Wilson, Jane D. Wilson and Paul K. Gibbons.

Brooklyn, N. Y.—Bids will be received until Oct. 9 by C. B. J. Snyder, Supt. School Bldgs., New York City, for installing electric equipment in additions to and alterations in School 27; installing electric light wiring and fixtures in the 4th story of Boys' High School, both in Boro. Brooklyn; also installing electric equipment in addition to and alterations in School 23, Boro. Richmond.

Geneva, N. Y.—The Bd. Pub. Wks. has passed a resolution authorizing the Supt. to receive bids for constructing 18,000 ft. of conduit, 1,200 of which is to be constructed on Castle St.

Broadalbin, N. Y.—The Broadalbin Electric Light & Power Co. has been incorporated, with a capital of $50,000, to supply light and power in Broadalbin, Mayfield and Providence. Directors: Wm. Pierson Judson, Henry C. Finch and others, all of Broadalbin.

Morehead City, N. C.—It is stated that Cincinnati capitalists have closed a contract with J. W. Riley, of Morehead City, to erect an electric light plant in that city, to cost about $15,000.

Columbus, O.—Bids will be received until Oct. 24 by the Bd. Trus. of the Pub. Library (John J. Pugh, Secy.) for furnishing and installing electric and gas light fixtures.

Loveland, O.—The Loveland Citizens' Electric Co. is reported to have decided to issue $50,000 bonds, to be used for the extension of the plant.

Lakewood, O.—Bids will be received until Oct. 3 by the Bd. Trus., Pub. Affairs (E. E. Sherwood, Pres.) for furnishing materials and building a brick addition to the electric light station and for installing complete, ready for piping, one new boiler at the Lakewood electric light plant.

Huntingdon, Pa.—The Juniata Hydro-Electric Co., with executive office in the Perry Bldg., Philadelphia, has commenced work on the development of an extensive water power on the Juniata River, near Huntingdon, Pa. A concrete-steel dam about 600 ft. long is now under construction, to be followed by a canal and power house. The contractors on the work are the Ambursen Hydraulic Construction Co., of Boston, Mass.

Bamberg, S. C.—An election will probably soon be held to vote on issuing bonds for water works and an electric light plant; probable cost, $25,000. G. Moye Dickinson, Mayor.

Aberdeen, S. D.—The voters of the town, it is reported, will soon vote on the issuing of $35,000 bonds to establish a municipal lighting plant or to grant a franchise to put in such a plant.

Chattanooga, Tenn.—The Chattanooga & Tennessee River Power Co. is reported to have been reorganized on Sept. 21 with C. E. James, of Chattanooga, president; J. C. Guild, of Chattanooga, chief engineer, and John Bogart, of New York, N. Y., as consulting engineer. It is expected that the work of constructing the dam will be started at once.

Wichita Falls, Tex.—The Wichita Falls Waterworks Co., it is stated, has amended its charter, changing its name to the Wichita Falls Water & Light Co., and increasing its capital from $50,000 to $75,000.

Humble, Tex.—The electric light and power plant, it is stated, has been destroyed by fire.

Richmond, Va.—The joint committee on Finance, Electricity and Water, on Sept. 22, after considering the report of Consulting Engr. E. W. Trafford on the proposed municipal electric light and power plant, adopted a resolution requesting City Attorney to prepare an ordinance for the issue of $500,000 light plant bonds. The plant proposed will have a capacity of 2,000 h.p.

Petersburg, Va.—Judge Waddill is reported to have authorized Wm. Northrop and Henry T. Wickham, of Richmond, receivers of the Virginia Passenger & Power Co., to expend $40,000 to complete the Appomattox Canal, the use of which is for the power plant near Petersburg.

**Centralia, Wash.*—The Kilbourne & Clark Co., of Seattle, is reported to have secured the contract for constructing an electric light system for Centralia.

Tacoma, Wash.—Bids will be received until Nov. 8 by L. W. Roys, City Clk., for constructing a water power electric generating plant to generate not less than 5,000 h. p. as a minimum, delivered on the low tension side of the transformers at the distributing station, and not more than 10,000 h.p. delivered on the low tension side of the said transformer.

Omro, Wis.—It is stated that the Village will change the electric street lighting from arcs to incandescent.

**Menasha, Wis.*—Kurz & Root, of Appleton, it is stated, have secured the contract for the city light plant at $9,100.

Little Chute, Wis.—The Village Bd. is reported to have granted a franchise to furnish electric lights to the Kaukauna Electric Co. (W. A. Nelson, Secy., Milwaukee).

Port Washington, Wis.—Wm. A. Tholen, City Clk., writes that the citizens voted Sept. 19 to issue $75,000 electric light and water works bonds.

Oshawa, Ont.—The Oshawa Light & Power Co., is reported incorporated, with a capital of $100,000.

Fort Frances, Ont.—The Council is said to be considering the installing of an electric light plant.

St. Catherines, Ont.—The City Council has passed on second reading the by-law to grant a 25-yr. franchise to the Hamilton Cataract Power Co., of Hamilton.

Toronto, Ont.—The Island Committee is stated to have asked Park Comr. Chambers and City Engr. Rust to prepare a report on the capacity of the present electric light plant on the Island, the number of lights provided; also estimated cost of new plant. The city is stated to have received authority at last session of Legislature to expend $40,000 for a new electric light plant on the Island.

Provo, Utah.—Geo. A. Snow is reported to have petitioned Council for a franchise for a gas plant.

ELECTRIC RAILWAYS.

Notes Arranged Alphabetically by States.

Marysville, Col.—Col. E. A. Forbes is stated to have announced that he has decided to build the proposed electric railway to Colusa, and that he has secured capital to the amount of $300,000 for the purpose. This is sufficient to build the road and transform the Marysville and Yuba City street car system into an electric road.

Woodland, Cal.—Chas. W. Pickard, City Clk., writes that no franchise was granted on Sept. 18 for an electric railway, but bids for new franchise will probably be received on Nov. 6.

The Supervisors are stated to have passed an ordinance granting a franchise to construct an electric railway over the highways of Yolo County to J. Reith, Jr.

Greenfield, Ind.—The Comrs. of Hancock County is stated to have granted a franchise to the Indianapolis, New Castle & Toledo Electric Ry. Co. for a branch line from Greenfield to Maxwell.

Vincennes, Ind.—The contract for the construction of the Vincennes, West Baden & Louisville Traction line is reported to have been awarded to Lewis Metsser, of New Orleans. The contract price is $3,000,000.

South Bend, Ind.—The City Council is stated to have granted a franchise to the Indianapolis, Logansport & South Bend Traction Co. The right of way for this line is about all secured, and the work of construction will begin soon.

Wabash, Ind.—It is stated that the Wabash & Rochester Traction Co. will soon receive bids for the completion of the track work and road bed of its line between Wabash and Rochester. R. S. Vivian, 107 Dearborn St., Chicago, Ill., may be addressed.

Indianapolis, Ind.—It is stated that the Indianapolis, Crawfordsville & Western Traction Co. will soon receive bids for the track and roadbed of the first section of its line between Indianapolis and Crawfordsville, a distance of 42 miles. Specifications have been prepared. W. D. Ball, Engr. First National Bank Bldg., Chicago, Ill., may be addressed.

Crawfordsville, Ind.—The Indianapolis, Crawfordsville & Western Traction Co. is stated to have been granted a franchise through several of the principal streets. The promoters announce that they will complete the road at once from Indianapolis to Crawfordsville and west to Danville, Ill. N. E. Reynolds, A. F. Ramsey, C. N. Vancleve, and others of Crawfordsville, are reported interested.

Tremont, Mass.—It is stated that the Plymouth, Carver & Wareham St. Ry. Co. will soon start constructing an electric railway from Wareham to Plymouth. The line will start at Tremont; the distance is 16 miles.

Kansas City, Mo.—Horace C. Stilwell, of Anderson, Ind., and Geo. F. McCulloch, of Muncie, Ind., are reported to be promoting the building of an interurban electric railway from Kansas City, Mo., to Topeka, Kan. There would be about 60 miles of main line.

St. Louis, Mo.—The St. Louis, Fern Ridge & Western Ry. Co. is stated to have applied for a franchise to build an electric railway from the western city limits to Creve Coeur Lake, entering at the southern end about 3 miles from the terminus of the United Railways line. Judge Wm. F. Pfister, Pres., Fern Ridge.

Lee's Summit, Mo.—Benj. S. Henderson, attorney for the Kansas City, Lee's Summit & Eastern Electric Ry., which is to be built from Kansas City to Lone Jack, Mo., a distance of 30 miles, is stated to have received a franchise to build and maintain a double track, standard gage, electric railway through the streets of the city. Ultimately the line will be extended to St. Louis.

Paterson, N. J.—The Bd. of Aldermen is stated to have on Sept. 19 passed the ordinance granting a franchise to the Rapid Transit Co.

Mantua, N. J.—The Public Service Corporation (Albert H. Stanley, Gen. Supt., Jersey City) will extend trolley lines south from Mantua and Haddon Heights.

Brooklyn, N. Y.—Counsel for the Rapid Transit Com. is reported to have received the last of the consents to the construction of a four-track subway in Fulton St. This consent gives the Commission the right to proceed with the work of four-tracking the subway through Fulton St.

Steubenville, O.—The Steubenville & Wellsburg Traction Co. is reported incorporated with $10,000 capital, by J. Dunbar, M. Keane, D. J. Sinclair, Robert McGowan and others. The company will build a line in Steubenville to connect with the line of the Tri-State Traction Co. for Wellsburg.

Cadiz, O.—E. C. Lewis is reported to be interested in the promotion of a line from Uhrichsville to Wheeling by way of Cadiz.

Lima, O.—The Lima & Eastern Ry. Co. is reported organized, with A. Baker, Pres.; F. O. Oleson, Vice-Pres. and Gen. Mgr.; C. D. Schrobe, Secy.-Treas. The company is stated to have secured a greater portion of the required right of way for a line from Lima to Kenton, with a spur line to Ada. The company plans to use gasoline motor cars.

Sandusky, O.—The Sandusky, Fremont & Tiffin Traction Co. is reported incorporated with $100,000 capital, by Chas. Thompson, W. H. Gilcher, John G. Dorn, D. B. Sharp and others. The company plans to build a line from Sandusky to Fremont and Tiffin, and it will form an important connection in the traction system of Northern Ohio. The Tiffin & Sandusky Constr. Co. is reported to have been chartered with $25,000 capital to build the road.

Dayton, O.—It is announced, according to reports, that the Dayton Southwestern project, which has been in the preliminary stages, will be pushed to completion. The road will extend from Dayton to Camden, and to Connersville, Ind. V. J. Drayer, Pres., Dayton. The Westinghouse Company is preparing plans for the equipment, and it is stated that contracts for the construction are to be closed in the near future.

Jefferson, O.—The Pennsylvania & Ohio Ry. Co. is reported to be planning to extend their Jefferson branch to Windsor and Middlefield, connecting at the latter point with the Eastern Ohio Traction Co. for Cleveland.

The Dayton, Covington & Piqua Traction Co. is reported to be planning to build a branch line to Phillipsburg.

Youngstown, O.—The Youngstown & Sharon Ry. Co. is stated to be purchasing additional right of way, with a view to double tracking the line between Youngstown and Sharon.

The Youngstown & Southern Ry. Co. is reported to be making surveys for its proposed extension from Columbinana to Salem.

Springfield, O.—The Springfield Ry. Co. is stated to have decided to extend its system by the construction of a new line on W. Pleasant St.

Cleveland, O.—The Cleveland, Berea & Southern Ry. Co. is reported incorporated, with $10,000 capital, by C. C. Downs, W. S. Mitchell, W. G. Benedict, Frank Cowdry and others. The company expects to build from South Brooklyn to Berea, 12 miles.

**Oklahoma City, Okla. Ter.*—The contract for constructing the Oklahoma City, Lexington & Sulphur Springs Electric Ry. is reported to have been awarded to J. W. Maney of El Reno. The line will be 8 miles in length.

Portland, Ore.—It is stated that bids are being received for constructing a trestle for the tracks of the Portland Consolidated Ry. Co. across the Columbia Slough bottom to the Columbia River. This trestle will be 12,000 ft. long and will be built across Shaw's Island. A. H. Richmond, Ch. Engr.

Pottsville, Pa.—The Council of Frackville is stated to have granted to the Tamauqua & Pottsville Electric Ry., a franchise through the town. A new branch between Pottsville and Shenandoah, 14 miles long, is about to be started.

Stroudsburg, Pa.—The Stroudsburg & Wind Gap Trolley Co. is reported to have been reorganized. The charter provides for the building of an electric railroad from Stroudsburg to Wind Gap via Kellersville, Sciota and Saylorsburg. J. B. Williams, pres.; Joseph Shiffer, vice-pres.; G. A. Schneebeli, treas.; E. P. Arbogast, secy. A committee has been appointed to secure all the rights of way.

Union City, Tenn.—The Union City & Reelfoot Ry. Co. is reported incorporated, with capital of $100,000. Incorporators: R. P. Whitesell, J. C. Burdock, T. B. Greer, A. E. Darrah, W. M. Turner and others.

Dallas, Tex.—The Texas Traction Co. (J. F. Strickland, Pres.) is stated to have announced that an electric railway will be constructed between Dallas and Sherman. The line will be about 62 miles in length.

Newport News, Va.—A corporation is reported to have been formed here for the purpose of constructing and operating a railway between Newport News and Yorktown. The company is to have capital of $300,000. Gasoline motor cars are to be used. The officers of the new corporation are reported to be as follows: W. A. Post, pres.; Chas. M. Graves, Jr., of Norfolk, secy.; Arthur Lee, treas.

New Westminster, B. C.—Wm. H. Moore, of Nelson, B. C., is reported to be promoting a scheme for the construction of an electric railway from this city to Spencer's Bridge, on the Thompson River, the line to be about 100 miles in length.

RAILROADS.

Notes Arranged Alphabetically by States.

San Francisco, Cal.—The Clear Lake & Southern R. R. Co. has been incorporated, with a capital of $3,500,000 by Jos. P. Lucey and Wm. T. Love of San Francisco; Guy C. Calden, of Oakland, and Kent J. C. Seymour, of Mill Valley. The company proposes to construct a railway through Marin, Sonoma, Napa and Lake Counties to Lakeport, connection to be made with San Francisco by ferry boats from the terminus on the Marin county shore. A branch railroad is to run from San Rafael to San Quentin, and another from the town of Reclamation, Sonoma county, to Petaluma.

Yalesville, Conn.—The New York, New Haven & Hartford R. R. (C. M. Ingersoll, Ch. Engr., New Haven), it is reported, is considering the building of a cut-off at Yalesville, by which the Hartford division will be connected with the Northampton at Plantsville.

Augusta, Ga.—It is reported that the Georgia R. R. (W. S. Brand, Supt., Augusta) has acquired the old road bed between Social Circle and Mansfield, in the eastern section of Newton County, and is said to be

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Items marked thus give the names of parties awarded contracts.

making plans for constructing the track and having the line in operation within the next few months.

Pocatello, Idaho.—The Yellowstone R. R. Co. is reported incorporated at Pocatello, to build, operate and maintain railroad lines and telephone and telegraph service between St. Anthony and the western boundary of Yellowstone park, a distance of 57 miles. Another line will leave St. Anthony and run 20 miles east and 50 miles south to the town of Victor in Bingham and Fremont Counties, Idaho, and Gallatin County, Mont. Principal place of business, Pocatello; capital, $125,000; incorporators: W. H. Bancroft, E. Buckingham, P. L. Williams and others.

Chicago, Ill.—It is reported that the Chicago, Milwaukee & St. Paul Ry. Co. (D. J. Whittemore, Ch. Engr., Chicago) is about to sell $25,000,000 additional common stock, the proceeds to be used to extend the system to the Pacific Coast.

The Chicago, Evanston & North Shore Ry. Co., of Chicago, has been incorporated to construct a line from a point in Chicago northerly to Wilmette; capital, $10,000. Incorporators: Geo. G. Wilcox, Frank R. Grover, Chas. S. Graves and others.

Dubuque, Ia.—Dubuque business men, it is reported, have organized the Dubuque & Wisconsin R. R. Co., and propose to build a steam road northeasterly from that city to Madison, Wis. It is stated that they have secured the use of the Illinois Central bridge and tracks to East Dubuque and have a corps of engineersr surveying the remainder of the route.

Angola, La.—The Louisiana Ry. & Navigation Co. (H. B. Helm, Gen. Supt., Shreveport, La.) is reported to have made a survey for a railroad from Angola to Natchez.

Baltimore, Md.—The Baltimore & Ohio R. R. (D D. Carothers, Ch. Engr., Baltimore), it is stated, has appropriated $750,000 to be expended in co-operation with the city authorities in abolishing grade crossings.

Norway, Me.—The State Bd. of Railroad Comrs., it is stated, has approved the location of the Norway & Western R. R. Co.'s proposed road, which is to run from a connection with the Grand Trunk Ry. at Norway, to Waterford, to Stoneham and to Albany, with a branch track to South Waterford. The road is to be 21 miles long, with a gauge of 4 ft. 8½ ins., and will be operated by steam. Directors: W. G. Rand, of Boston; Jonathan Bartlett, of Stoneham, and others.

Fitchburg, Mass.—City Engineer David A. Hartwell, it is stated, has submitted a report to the City Council relative to the abolishing of grade crossings in the city. He estimates the cost at $258,234, $115,000 being for land damages.

Menominee, Mich.—The Quinnesec & Western R. R. Co., it is stated, has been incorporated in Michigan for the purpose of building an extension to the Wisconsin & Michigan R. R., about 15 miles long, in Menominee County, Mich. Incorporators: W. T. Fitzgerald, Pestigo, Wis.; E. C. Eastman, Marinette, Wis.; T. M. Butters, Chicago, Ill., and others. Capital $120,000.

Champion, Mich.—The Lake Superior & Southern Ry. Co. has been incorporated with a capital of $750,000, to construct a railroad from Champion to Huron Bay, a distance of 36 miles. M. C. Phillips, Pres., Oshkosh; R. P. Bronson, Vice-Pres., Ishpeming; W. K. Rideout, Treas., Oshkosh, and John O. Maxey, Secy., Marquette.

Huntsville, Mo.—Articles of incorporation have been issued by the Secretary of State to Norman's Southwestern Ry. Co., of Huntsville, which, it is stated, proposes to build a standard-gauge railroad, 12 miles in length, all within Stoddard County. Capital $120,000. Incorporators: W. W. Norman, S. A. Ruch, C. A. Vernon, and others.

Concord, N. H.—Only preliminary work has yet been done in connection with abolishing grade crossings on the Boston & Maine R. R. (Engineer, Frank A. Merrill, Concord) at Ferry and Penacook Sts. Action must be first taken by the State R. R. Comrs.

Las Vegas, Nev.—The Las Vegas & Tonopah R. R. Co., it is stated, has been incorporated with a capital of $4,000,000, and intends building a line from Las Vegas on the Salt Lake route, through the Bullfrog and Goldfield regions to Tonopah. Incorporators: W. H. Comstock and C. O. Whittlemore, of Los Angeles, Cal., and others. It is reported that the San Pedro, Los Angeles & Salt Lake R. R. (W. A. Clark, Pres., Butte, Mont.) is back of this road.

Carson, Nev.—The Virginia & Truckee R. R., at Carson (W. H. Kirk, Ch. Engr. & Supt. Track, Carson), it is stated, has closed a contract for the first 18 miles of its new road, and, it is reported, that other contracts will probably be let in the near future.

Guthrie, Okla. Ter.—The Texas, Oklahoma & Northwestern R. R. Co., with $2,500,000 capital, and with headquarters at Guthrie and New York City, it is stated, has been incorporated to build a line 450 miles long. Directors: Senator A. H. Huston, John Devereaux, of Guthrie; Henry Knapp, of New York City, and others. The proposed line will run from the boundary line, between the Chickasaw Indian Nation and Caddo County, Okla. Ter., northwest to a point on the Cimarron River, in Wood County, traversing the counties of Blaine, Kingfisher and Logan to Guthrie and a Western line traversing the Counties of Roger Mills and Day. It is proposed to begin construction at Thomas or Custer City on the Orient road, running northwest to Taloga and Lenora, in Dewey County; Hydro and Virden; east to Guthrie, passing through Kingfisher, and southwest through Cheyenne into Texas.

Cincinnati, O.—The Erie R. R. Co. (F. L. Stuart, Ch. Engr., New York, N. Y.) is reported to have purchased a majority of the stock of the Cincinnati, Hamilton & Dayton R. R. Co. By this purchase the Erie R. R. has acquired between 3,500 and 4,000 additional miles of trackage. At Chicago, which is the Western terminus of the Erie R. R., it will connect by the new purchase with a number of the principal cities in Ohio and Michigan.

Portland, Ore.—The Portland & Seattle R. R. Co. is reported incorporated to construct a railroad down the north bank of Columbia River, from Wallula to Vancouver, and 7 miles across Willamette into Portland with a bridge across Columbia River. Jas. D. Hoge, of Seattle, Wash., Pres. Union Savings Bank, and C. F. Adams, of the Portland Gas Co., are among the incorporators.

Pottsville, Pa.—Engineers of the Philadelphia & Reading R. R. Co. (Wm. Hunter, Ch. Engr., Philadelphia) are stated to have completed a survey for a proposed new route to connect Schuylkill and Susquehanna valleys.

Philadelphia, Pa.—Common Council has passed the ordinance to submit to the people at the Nov. election the question of creating a permanent loan of $6,000,000 to abolish grade crossings.

Harmony, S. C.—The Southern Power Co., of Charlotte, N. C., it is reported, intends building a railroad from Harmony to Camden, a distance of about 50 miles, connecting at Ft. Lawn, with a link from the company's plant at Catawba Falls. The work of surveying the route, it is stated, will begin at an early date, and the total cost of the road, it is reported, will be over $600,000. Dr. W. Gill Wylie, 215 W. 43d St., New York, N. Y., is Pres. of the company.

Spokane, Wash.—The Northern Pacific Ry. Co. (E. J. Pearson, Ch. Engr., St. Paul, Minn.), it is reported, is planning to raise the tracks and lower the streets, in order to do away with the grade crossings.

Viroqua, Wis.—The La Crosse & Southeastern R. R. Co. (Geo. P. Bradish, Ch. Engr., La Crosse), it is stated, is planning an extension of their line from Viroqua to Richland Center.

PUBLIC BUILDINGS.

Notes Arranged Alphabetically by States.

Los Angeles, Cal.—It is reported that plans are being prepared for a 5-story county building, 280x72 ft., which is to cost about $400,000.

Greeley, Colo.—It is stated that a brick and stone city hall is to be erected here at a cost of $25,000.

Washington, D. C.—Bids will be received until Oct. 11 by Elliott Woods, Supt. U. S. Bldgs. and Grounds, for furnishing and delivering about 9,000,000 good, sound red brick, for use in connection with the construction of the Senate and House office buildings.

Brunswick, Ga.—The plans of Gifford & Betts, 18 E. 17th St., New York, N. Y., are stated to have been accepted for the court house to be erected here, to cost $55,000.

Macon, Ga.—Alex. Blair, of Macon, it is stated, has been engaged to prepare plans for a $50,000 structure for the Academy for the Blind.

Joliet, Ill.—The erection of a city hall at a cost of about $150,000 is reported under consideration.

Pontiac, Ill.—It is stated that the Bd. of Superv. has adopted plans for the remodeling of the county jail at a cost of $18,000.

**Galesburg, Ill.*—Peter T. Olson, 1020 Bateman St., it is reported, has received the contract to erect the fire station, not including heating, at $27,373, and the contract for the jail, including cages, iron doors and fixtures, at $11,227.

Peoria, Ill.—It is reported that a chapel will be built at the St. Francis Hospital, to cost $100,000, and an addition to the hospital to cost $40,000 is also contemplated.

Madison, Ind.—It is reported that Madison has been selected as the city in which the new insane asylum and power house is to be erected, and it is stated that bids for the construction will be asked by the State House Comrs. soon. Appropriation, $360,000.

Indianapolis, Ind.—A. W. Butler, Secy. Bd. State Charities, it is stated, has approved plans for new poor asylums to be erected at Petersburg, Pike County, Rockville, Parke County and Washington, Daviess County, and it is reported that bids for the erection of said buildings will be asked by the Co. Comrs.

**Seymour, Ind.*—Anton Massman, it is reported, has secured the contract to erect the city building at $15,000.

**Burlington, Ia.*—Bartlett & Kling, of Cedar Rapids, have secured the contract for constructing complete the extension to the U. S. Post-Office at Burlington (bids opened Aug. 17) for $32,950.

Ft. Leavenworth, Kan.—It is stated that plans for the College buildings at Ft. Leavenworth have been approved by the War Dept., and it is reported that as soon as the plans are received by the Quarter Master at Ft. Leavenworth bids for the erection will be asked. Appropriation $100,000.

Baltimore, Md.—It is stated that an ordinance has passed the Councils appropriating $25,000 for the construction and equipment of an infectious disease hospital on Hardesty tract.

*The contract to erect a field house in Patterson Park, it is stated, has been awarded to Jos. Schamberger, 2216 Boyer St., at $19,896.

Annapolis, Md.—It is stated that bids were opened Sept. 20 at the Navy Dept., Washington, for erecting an administration building at the U. S. Naval Academy, Annapolis, the Noel Constr. Co., of Baltimore, Md., bid $59,000 for the entire work and the General Supply & Constr. Co., of N. Y. City, N. Y., $62,950 for the entire work, or $9,280 for the granite work alone.

Hyde Park, Mass.—The Special Town Com. on fire station have voted to erect a new central station, at a cost of $22,000.

**Westfield, Mass.*—The Trus. of the Noble Hospital, it is stated, have awarded the contract for erecting the surgical ward addition to the hospital to H. C. Wood & Co., of Westfield, at $20,910.

Ft. Brady, Mich.—Bids will be received until Oct. 14 by Lieut. C. S. Hoffman, Q. M., for furnishing material and repairing guard house and constructing administration building.

Muskegon, Mich.—The Co. Bd. Superv., it is stated, intend rebuilding the poor house, which was destroyed by fire recently.

Ft. Snelling, Minn.—Bids will be received until Oct. 7 by Amos W. Kimball, Constr. Q. M., St. Paul, for installing steam heating plant in store house at Ft. Snelling.

Clara City, Minn.—Bids will be received until Oct. 3d by the Village Council, for erecting a village hall. John B. Stager, Village Recorder.

**Two Harbors, Minn.*—W. F. Lawrence, Deputy Co. Aud., writes that the contract for erecting the court house (bids opened Sept. 16) has been awarded to Pastoret & Lunz, of Two Harbors, for $62,250.

Minneapolis, Minn.—The State Fair Assoc., it is stated, will have plans prepared this spring for an amphitheatre which it is proposed erecting on the fair grounds. It is to be of brick and stone or concrete, 600x250 ft., and is to cost about $150,000.

St. Paul, Minn.—Plans have been submitted to the Park Bd. by Jas. A. MacLeod for the pavilion in Como Park, and it is stated, that bids for constructing the foundation of said pavilion will probably soon be asked.

Winnipeg, Man.—It is stated that all bids received recently for erecting the civic building have been rejected as they were too high. Appropriation, $200,000.

Fargo, N. D.—The plans of M. E. Beebe, of Fargo, it is stated, have been acepted for the city hall, and it is stated that bids will be received in October by the City Auditor for the construction. Bids are to be submitted separately on the general construction, and on the plumbing, heating and electric wiring. The estimated cost of the structure is $20,000.

Bismarck, N. D.—T. R. Shaw, Secy. Capitol Comn., writes that the date of opening of bids for remodeling the Capitol has been extended from Sept. 19 to Dec. 12.

New York, N. Y.—The following are bids opened Sept. 21 by the Park Board for furnishing materials and erecting a comfort building in the New York Zoological Park in Bronx Park: Jas. J. Buckley, 408 10th Ave., $19,200; Buckley Realty Constr. Co., Times Bldg., $23,250; John H. Deeves, 244 W. 132d St., $22,000; William Guggolz, 2265 Washington Ave., $26,420; Guidone & Galardi, 1 Madison Ave., $22,582; J. & L. Moreland Co., 1910 Park Ave., $22,590; Alfred Nugents Son, 103 E. 125th St., $22,796; Lawrence J. Rice, 5 E. 42d St., $25,281; John V. Schaefer, Jr., & Co., 9 E. 59th St., $19,403; Francis Sullivan, 103 E. 125th St., $19,995, and Geo. L. Walker Co., 234 W. 104th St., $22,100.

Bids will be received until Oct. 7 by Louis F. Haffen, Pres. Boro. Bronx, for excavation, sewer and water connections for the Free Public Bath, to be erected on 156th St. and Elton Ave.

Ft. Michie, N. Y.—Bids will be received by the Constr. Q. M., New London, Conn., until Oct. 6 for constructing, heating, plumbing and electric wiring hospital at Ft. Michie.

Plattsburgh Barracks, N. Y.—Bids will be received by Capt. T. B. Lamoreux, Q. M., U. S. A., Burlington, Vt., until Oct. 7, for constructing, plumbing, hot water heating and gas piping of an addition to the post hospital at Plattsburg Barracks, as advertised in The Engineering Record.

Ft. H. G. Wright, N. Y.—Bids will be received by the Constr. Q. M., U. S. A., New London, Conn., until Oct. 13 (not Oct. 30 as previously stated) for alterations to administration building and the installation of a steam heating system therein, at Ft. H. G. Wright.

**Napanoch, N. Y.*—The Hudson Valley Constr. Co., Times Bldg., Troy, secured the contract on Sept. 19 for the construction of a trades school building at the Eastern New York Reformatory at Napanoch, for $35,000.

**Akron, O.*—Carmichael & Co., of Akron, it is reported, have secured the contract to erect the court house (bids opened Sept. 20) at $238,250.

Springfield, O.—Bids will be received until Oct. 3 by the Bd. Pub. Service (Chas. C. Bauer, Clk.) for installing a complete vacuum system (either the Webster or Paul) and remodeling steam pipes in the City Bldg.

Bids will be received until Oct. 14 by the Bd. Co. Comrs. for furnishing materials and erecting a 4-room brick cottage on the grounds of the Co. Children's Home. A. R. Hahn, Co. Aud.

**Cleveland, O.*—Michael Heints, it is reported, has secured the contract for the carpenter work on the branch library which is to be erected on Crawford Road at $32,000.

**Oklahoma City, Okla. Ter.*—Robt. Kreuger, of Oklahoma City, it is stated, has received the contract to erect the county jail at a cost of about $25,000.

Pittsburg, Pa.—Simeon Eisendrath, Farmers' Bank Bldg., it is stated, has prepared plans for a 3-story brick hospital which the Hebrew Ladies Hospital Aid Society intends erecting at Reed and Roberts Sts., at a cost of about $75,000.

Ft. Meade, S. D.—Bids will be received until Oct. 13 by Maj. Geo. K. Hunter, Constr. Q. M., for window screens, storm sash and storm vestibules for 6 public buildings at Ft. Meade.

Ft. McIntosh, Tex.—Bids will be received until Oct. 19 by Robt. R. Stevens, Ch. Q. M., U. S. A., San Antonio, for constructing 3 brick lavatories for barracks, including installing of plumbing and heating at Ft. McIntosh

Houston, Tex.—Chas. H. Page, of Austin, it is stated, is preparing plans for a hospital which is to be erected for the city at a cost of $40,000. A site and $20,000 has been donated by Geo. H. Hermann for the purpose.

**Burlingon, Vt.*—The G. S. Blodgett Co., of Burlington, it is stated, has received the contract for the installing of a heating system in the U. S. Post-Office at Burlington (bids opened Aug. 31) at $5,340.

Staunton, Va.—Bids will be received until Oct. 21 by the Bldg. Com. (Thos. M. Smiley, Chmn.) at the Co. Clk.'s office for erecting a new county building on S. Augusta St. T. J. Collins & Sons, Archts., Crowle Bldg.

**Hurley, Wis.*—Daniel Egan, of Ashland, it is stated, has secured the contract to erect the town hall at $15,000.

Toronto, Ont.—Bids will be received until Oct. 14 by the Dept. Pub. Wks. (Fred. Gelinas, Secy.), Ottawa, for addition to drill hall at Toronto. S. G. Curry, Archt., 90 Yonge St.

BUSINESS BUILDINGS.

Notes Arranged Alphabetically by States.

Birmingham, Ala.—The Interstate Amusement Co., it is reported, has had plans prepared for a theatre and amusement house, to be erected at 3d Ave. and 18th St., at a cost of about $35,000.

Oakland, Cal.—The Local Lodges of the Woodmen

***Items marked thus give the names of parties awarded contracts.**

of the World, it is stated, will erect a lodge hall to be 4 stories high and cost $20,000.

Santa Barbara, Cal.—S. A. Kennedy, it is reported, is interested in a company being formed for the purpose of erecting a theatre, to cost $50,000.

Denver, Colo.—E. P. Varian, Nassau Bldg., has prepared plans for a 2-story brick and stone store building, to be erected at 15th St. and Colfax Ave., for E. A. Colburn, to cost $15,000.

**Augusta, Ga.*—A. K. Rowlands, 1831 Walton Way, it is stated, has secured the contract to erect a passenger and freight station for the Augusta-Aiken Ry. Co., at McIntosh and Reynolds St., to cost about $15,000.

Chicago, Ill.—Huehl & Schmid, 163 Randolph St., are the architects of a $100,000 six story warehouse of fireproof construction and 101x130 ft., which is to be built at 40th St. and Calumet Ave. for C. C. Harden. The same architects have prepared plans for a $25,000 addition to the department store of E. H. Knoop, at 251 North Ave.

A. J. Buerger, 1533 S. 42d Ave., has prepared plans for a bank, office and hall building on W. Madison St., near 41st Ave., to be erected for E. E. Drake, at a cost of $35,000.

**Indianapolis, Ind.*—The contract to erect the Herron Art Inst. Bldg. of Milwaukee brick and Bedford stone, it is stated, has been awarded to Brandt Bros., of Indianapolis, at $49,124.

It is reported that the Bldg. Com. (C. S. Denny, Chmn.) will receive bids for erecting a building for the Knights of Pythias, which is to cost about $30,000. Rubush & Hunter, Archts., Fitzgerald Bldg.

French Licks, Ind.—W. H. Floyd, of Terre Haute, it is stated, has been engaged to prepare plans for a $150,000 hotel which is to be erected at French Licks by Al. Brown. It is to be a 4-story brick structure, 200x150x 150 ft.

Des Moines, Ia.—It is stated that a 3-story brick, 70x 44 ft. warehouse is to be erected for the C. O. D. Produce Co., on E. 6th St. and Court Ave.

Hallett & Rawson, 15 Walnut St., it is stated, have prepared plans for a 3-story and basement Settlement House which it is proposed erecting on E. 7th and Scott Sts., at a cost of about $18,000.

**Sioux City, Ia.*—The contract to erect a storage house for the Bekins Van & Storage Co., it is stated, has been awarded to Frank T. Houx Co., at $40,000.

Davenport, Ia.—Archts. Temple, Burrows & McLane, of Davenport, write that bids will be received about Jan. 1 for the erection of a hotel for the Davenport Hotel Co., to cost about $200,000.

Coffeyville, Kan.—It is stated that the Commercial Club is contemplating the erection of an opera house to cost about $40,000.

Lexington, Ky.—It is stated that the Masons are contemplating the erection of a temple to cost about $75,000. K. G. Pullium may be able to give further information.

Baltimore, Md.—M. Gillett Gill, it is stated, is about to erect a 2-story garage at Mt. Royal and Maryland Aves. Howard Gill and Stanley Zell, it is stated, are to have charge of the garage.

Riverside, Md.—The Baltimore & Ohio R. R. Co. (D. D. Carothers, Ch. Engr., Baltimore, Md.), it is stated, has filed plans for 7 buildings to be erected at Riverside on Jackson St. The plans include 2 roundhouses, each 96 x 536 ft., a structure containing an engine and boiler room, blacksmith shop, machine shop, carpenter shop and an office and storage room, 100x260 ft.; an oil house, 30x50 ft.; a coal shute, 40x150 ft.; a sand house, 25x 75 ft., and a tipple, 25x537 ft. The total cost, it is reported, will be about $350,000.

Worcester, Mass.—C. W. Fisher, 340 Main St., is preparing plans for a building to be erected on Main St. for the I. O. O. F. Contract for foundation is stated to have been awarded to G. H. Cutting & Co., of Worcester.

Boston, Mass.—C. A. Dodge & Co., 8 Beacon St., have secured the contract for alterations to the A. Shuman & Co. Bldg.,on Washington and Summer Sts.; cost, $57,000.

Marshall, Mich.—The Knights of Pythias, it is stated, intend erecting a 2-story lodge building, to cost about $10,000.

Muskegon, Mich.—It is reported that improvements are to be made to the Occidental Hotel at a cost of about $20,000. Chas. Schoenberg, owner.

Benton Harbor, Mich.—The Lodge of Elks, it is stated, intends erecting a temple, to cost $25,000.

St. Paul, Minn.—The Lodge of Elks, it is reported, has decided to erect a lodge hall, to cost about $50,000.

St. Louis, Mo.—Edw. Butler, of St. Louis, it is reported, has purchased a site near Tower Grove Park and intends erecting a 10-story hotel to cost $700,000.

Kansas City, Mo.—Marshall & Fox, of Chicago, Ill., it is reported, are preparing plans for a store and office building 16 stories high, to cost $750,000, and a theatre, 80x140 ft., to cost $200,000, both buildings to be erected at Baltimore and 10th Sts., by Sam S. Shubert, of N. Y. City, and others.

Howe, Hoit & Cutler have prepared plans for a brick office building to be erected at 924-26 Grand Ave., to cost about $700,000.

Kansas City, Mo.—Marshall & Fox, of Chicago, Ill., it is reported, are preparing plans for a theatre to be erected here by Shubert Bros., at a cost of about $1,000,000.

Butte, Mont.—It is stated that fire on Sept. 24 destroyed 12 business houses between Park and Galena Sts., including the Symons Dry Goods Co. department store building.

**Fairbury, Neb.*—The contract to erect the roundhouse for the Rock Island R. R. at Fairbury, it is stated, has been awarded to O. G. Collier and Henry Stuteross, both of Fairbury, the total cost to be about $30,000.

Raleigh, N. C.—Bids will be received until Oct. 7 by Grand Master, Grand Lodge of N. C., care Chas. K. Bryant, Archt., 1014 E. Main St., Richmond, Va,. for erecting the Masonic Temple, at Raleigh.

**Cleveland, O.*—Masters & Mullen, it is stated, have secured the contract to erect a warehouse of concrete steel construction on Bway. for the Bway. Warehouse Co., which is to cost about $75,000.

Elyria, O.—F. Wolf, it is stated, submitted the lowest bid for erecting the Masonic Temple at $52,000, not including heating, plumbing and lighting.

Toledo, O.—David L. Stine, The Valentine, it is stated, is preparing plans for a rathskeller and cafe and dancing pavilion and bath house, which the Cedar Point Pleasure Resort Co. intends erecting at Cedar Point, the total cost to be about $75,000.

Oklahoma, Okla. Ter.—The Alexander Drug Co., it is stated, will erect a four-story and basement building at Harvey and First Sts., to cost $30,000

Ogontz, Pa.—Churchman & Thomas, of Philadelphia, it is stated, have been engaged to prepare plans for a 1-story memorial building, 30x70 ft., to be erected by the Jay Cooke estate at a cost of $10,000.

Sheridan, Pa.—Thos. Boyd & Co., of Pittsburg, it is reported, are preparing plans for a hotel which O. Smith intends erecting here at a cost of $25,000.

McKeesport, Pa.—Division No. 16, Ancient Order of Hibernians, it is stated, is planning the erection of a club house on 6th Ave., to cost about $50,000. John J. Gibbons, Pres.

East Pittsburg, Pa.—The Pennsylvania R. R. Co. (W. H. Brown, Ch. Engr., Philadelphia), it is stated, intends making improvements along its line which will include the erection of a passenger station at East Pittsburg, and the construction of a concrete wall, 1½ miles in length, 18 ft. high and 10 ft. thick at the base. The cost of the wall and station, it is reported, will be about $250,000.

Erie, Pa.—Jacob Roth, it is stated, is contemplating the erection of a 2-story brick garage building on State and 11th Sts., to cost about $70,000.

Pittsburg, Pa.—F. E. Schenck, it is stated, has secured a permit to erect a 6-story concrete warehouse at 432 Penn Ave., to cost $60,000.

It is stated that the Pittsburg Life & Trust Co. is planning to erect a building at Liberty Ave. and 6th St. probably 20 stories high, to cost about $2,000,000.

H. L. Kreusler, 3301 Penn Ave., it is reported, has received the contract to erect a warehouse for John Farrell at a cost of $50,000.

It is stated that F. C. Frick has engaged a number of leading architects of the country to prepare plans for the $10,000,000 hotel which he proposes erecting on the site of the old Cathedral on 5th Ave.

**Philadelphia, Pa.*—Henderson & Co., 1221 Arch St., have secured a permit to erect a 2-story brick stable at 1921 Cherry St., to cost $20,000.

*John R. Wiggins & Co., Heed Bldg., has secured a permit to make alterations to cafe at 13th and Walnut Sts., for C. F. Rump, at a cost of $40,000.

Nashville, Tenn.—The Nashville Railway & Light Co. has secured a permit to erect a car house between 3d and 4th Aves., N. The cost of the building will be $60,000. For some weeks work has been in progress tearing down the old buildings on the property and clearing up the ground preparatory to erecting the new car houses.

Bonaqua, Tex.—It is reported that the Bon Aqua Springs Hotel Co. has been incorporated with a capital of $100,000, for the purpose of erecting a hotel near Bonaqua Springs.

**Richmond, Va.*—John T. Wilson, Room 903, Mutual Assurance Society Bldg., has secured contracts for the erection of a new auditorium and for rebuilding Jefferson Hotel, 10 stories, fireproof construction, at a cost of between $500,000 and $600,000. Work will be commenced at once.

Norfolk, Va.—The Colonial Corporation Co., of Norfolk, it is stated, will erect a $150,000 7-story hotel and theatre here.

**Spokane, Wash.*—M. C. Murphy, it is stated, has secured the contract to erect a theatre on Howard St. for Geo. Turner, to cost $34,400.

Seattle, Wash.—W. D. Kimball, N. Y. Blk., it is reported, has prepared plans for a 7-story stone and steel business block which Joshua Green intends erecting at 4th Ave. and Pike St.

Seattle, Wash.—It is reported that an annex is to be erected to the Diller Hotel at a cost of $20,000. Mrs. L. Diller, owner.

**Fairmount, W. Va.*—The Bldg. Com., it is reported, has awarded the contract to erect the Masonic Temple to the Brady Constr. Co., of Fairmount, at a cost of about $100,000.

Grafton, W. Va.—The Baltimore & Ohio R. R. Co. (U. E. Greiner, Engr. Bridges & Bldgs., Baltimore, Md.), it is stated, is planning to erect a depot here to cost about $100,000.

Milwaukee, Wis.—Plans have been filed for a 6-story $250,000 mercantile building, which is to be erected at 2d and Sycamore Sts., for Alfred Uihlein.

Ogden, Utah.—John Scowcroft & Sons Co., it is stated, intends erecting a 5 or 6-story warehouse opposite their present building, to cost about $75,000.

Winnipeg, Man.—Darling & Pearson, of Toronto, Ont., it is stated, are preparing plans for a mercantile warehouse, about 10 stories high, which is to be erected on Lombard St., by an English syndicate of which B. Archer is the representative.

CHURCHES AND DWELLINGS.

Notes Arranged Alphabetically by States.

Denver, Colo.—W. R. Fisher has prepared plans for a brick residence to be erected at 1328 Gilpin St., to cost $15,000.

Geo. L. Bettcher, Mack Bldg., has prepared plans for a 3-story brick apartment house, to be erected on 14th St. for Chas. Halbery, to cost $28,000.

Chicago, Ill.—Zachary T. Davis, 79 Dearborn St., it is stated, has prepared plans for a 1-story brick and stone edifice, to be erected at 47th St. and Ellis Ave., for the St. Ambrose R. C. Church (Rev. Wm. Foley, pastor), at an estimated cost of $70,000.

Wm. J. McWade, the builder, it is stated, has had new plans prepared by Postle & Mahler, 204 Dearborn St., for a 3-story apartment building, the construction of which was abandoned several years ago. This building will be erected at 47th St. and Vincennes Ave., and will cost $250,000.

Thos. Wing, 184 Dearborn St., has prepared plans for a 3-story apartment, 150x100 ft., to be erected at 56th St. and Madison Ave., for Albert R. Boudell, at a cost of $70,000.

A building permit has been granted to Marcus C. Anderson to erect a 3-story brick apartment house at 1442 Eastworth Ave., at a cost of $25,000.

Oak Park, Ill.—Frank L. Wright, of Oak Park, it is stated, has prepared plans for a new edifice for the Unity Church, the cost to be about $35,000.

Parsons, Kan.—The Official Bd. of the First Presbyterian Church, it is reported, has accepted the plans of Chas. W. Squires, of Emporia, for a new edifice which it is proposed erecting at a cost of $25,000. Dr. Davis, Pastor.

Louisville, Ky.—A building permit, it is stated, has been granted to R. Jeunesse to erect a 3-story flat on Gray St., to cost $10,000.

Fall River, Mass.—The Dominican Fathers are preparing plans for a convent. Probable cost $30,000. Rev. Charland of the Order is the architect.

**Springfield, Mass.*—Ernest L. Sampson, of Plymouth, it is stated, has secured the contract to erect St. Peter's Church at 25 Buckingham St., at a cost of about $20,000.

Kansas City, Mo.—A. G. Consaul will erect brick apartment house at 2615 to 2625 E. 31st St., to cost $44,000.

**St. Louis, Mo.*—A. Lindstrom, it is stated, has secured the contract to erect the Salem Methodist Church, Sunday School building and parsonage at Page and Pendleton Aves., the cost to be about $50,000. F. C. Bonsack, of St. Louis, Mo., and Trumbull & Jones, of Elgin, Ill., it is stated, were the assoc. archts.

Newark, N. J.—It is reported that plans have been prepared for a new edifice for the Christ Reformed Church at a cost of $20,000. Rev. Henry Merle Mellen, Pastor.

New York, N. Y.—Plans have been filed for a concrete and stone edifice and dwelling to be erected at 45 W. 134th St. for the Congregation of the Mercy Seat Baptist Church, at a cost of $50,000. Jas. J. F. Gavigan, 1123 B'way., is the archt.

Toledo, O.—The National Realty Co., it is stated, intends erecting a 3-story brick and stone apartment house on Horton St., to cost about $100,000.

Akron, O.—It s stated that a $200,000 edifice is to be erected for St. Paul's Episcopal Church, as a memorial to the wife of O. C. Barber.

**Pittsburg, Pa.*—Thos. Reilly, 1616 Thompson St., it is stated, has been granted a permit to remodel the residence at 1523 Locust St., for John H. Converse, at a cost of about $25,000.

J. W. McCarthy, of Mellon, 18th ward, has had plans prepared for a $25,000 apartment house.

**Philadelphia, Pa.*—H. B. Shoemaker & Co., 17 S. 9th St., it is stated, have secured the contract to erect a 2-story stone edifice for the First African Baptist Church, on 16th and Christian Sts., at a cost of $40,000.

*The Chas. McCaul Co. has been awarded a contract for a three-story brick and limestone residence, 25x60 ft., to be erected at Spruce and Melvale Sts., for Francis J. Hill. Cost, $18,000. Mahlon H. Dickinson, 2d, Land Title Bldg., Archt.

**Millmont, Pa.*—L. H. Focht, of Reading, it is reported, has been awarded the contract for erecting the new convent building and Mother House of the Sister of St. Bernardina at Orrton, near Millmont. The cost will be about $50,000.

**Greensburg, Pa.*—Henry Shenk, of Pittsburg, it is stated, has received the contract to erect a residence for Thos. Lynch in this town to cost $100,000.

Harrisburg, Pa.—It is reported that a permit has been granted for the erection of the St. Michaels German Lutheran Church, which is to cost about $18,500. Address Pastor.

**Memphis, Tenn.*—L. T. Lindsley, Builders' Exchange, it is stated, has been awarded the contract for the $20,000 residence for Finley W. Faxon.

SCHOOLS.

Notes Arranged Alphabetically by States.

**Fayetteville, Ark.*—H. F. Regan, Secy. Bd. Trus. Univ. of Arkansas, writes that the contract for erecting 5 brick and stone buildings and 1 stone building for Univ. of Arkansas (bids opened Sept. 9) has been awarded to Donagaughy & McIlvey, of Fayetteville, for $99,000.

San Francisco, Cal.—The School Bd. has approved plans prepared by Shea & Shea, 26 Montgomery St., for an addition which it is proposed erecting to the Richmond School. It is stated that the Bd. of Wks. will soon ask bids for the construction of same. Appropriation $12,000.

Downey, Cal.—It is reported that plans have been prepared by A. C. Smith, of Los Angeles, for a high school, to be erected by the trustees of the Downey Union School, at a cost of $20,000.

Red Bluff, Cal.—It is stated that a school is to be erected here at a cost of $25,000.

Wallingford, Conn.—Bids will be received until Oct. 10 by the Bldg. Com., Central School Dist. (Geo. T. Jones, Chmn.) for erecting a brick and stone school. Bids may be submitted as a whole or separately on the following: Masonry, carpentry, etc.; plumbing, ventilating and heating; electric wiring. Richard Williams, Archt., New Haven.

Washington Barracks, D. C.—Bids will be received until Oct. 26 by Capt. John Stephen Sewell, Corps Engrs., U. S. A., for roof work and skylights for Army War College Bldg., as advertised in The Engineering Record.

Oak Park, Ill.—It is stated that Patton & Miller, Hartford Bldg., Chicago, will receive bids until Oct. 9 for erecting a school here to be a 3-story fireproof structure and cost about $160,000.

Monmouth, Ill.—Andrew Carnegie, it is reported, has given $30,000 to Monmouth College. It is stated that an additional $30,000 is to be raised, and a library costing $60,000 is to be erected at the college. T. H. McMichael is Pres. of the College.

Monticello, Ind.—It is stated that the high school which was recently destroyed by fire is to be rebuilt at a cost of about $25,000.

**Ft. Wayne, Ind.*—The following are reported to be the bids received Sept. 11 by the School Bd. for the general construction of the Jefferson school on Fairfield Ave. and Jefferson St.; Ernst Rump, $42,653; H. Mollet, $44,400; Charles Wermuth, $42,987; Wehrenberg & Buesching, $42,298; Irmscher & Westhoff, $41,909 (awarded contract); Fred Breimeier, $44,400; C. F. Hilgemann, $42,798; J. M. Henry, $45,946. P. B. Arnold, it is stated, secured the contract for the electric wiring

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****Items marked thus give the names of parties awarded contracts.***

at $499; M. F. Noll, Ft. Wayne, the plumbing, at $2,279, and Lewis & Kitchen, Chicago, Ill., the contract for heating at $7,777.

Hammond, Ind.—It is reported that the School Bd. has ordered plans prepared for a $25,000 school and for improvements to be made to 3 other schools.

**Logan, Ia.*—C. E. Atkinson, of Webster City, it is stated, has received the contract to erect the high school at $26,000.

Monticello, Ky.—It is stated thaat bids will be received until Oct. 4 by the Bd. Trus. (J. A. Patton, Secy.) for erecting a brick school.

Lexington, Ky.—The Bd. of Trus. of the Reform School, it is stated, is contemplating the erection of a hospital and 2 dormitories, to cost $50,000.

Holyoke, Mass.—The following are reported to be the bids opened by the Bd. Pub. Wks. on Sept. 22 for erecting the South Holyoke School: Louis A. Lafrance, $56,193; D. O'Connell's Sons (2 bids) $60,663 and $65,663; Lynch Bros. Brick Co., $64,750; L. T. Beaulieu (2 bids) $64,825 and $70,000; A. D. McCormick, $64,900, and F. F. Opeil (2 bids) $66,000 and $65,663. Bids were also received for the ventilating, heating and plumbing of same.

Hibbing, Minn.—The erection of a 10-room school in School Dist. No. 27, at a cost of $50,000, is reported under consideration.

Paterson, N. J.—Bids will be received until Oct. 3 by the Bd. Educ. (Wm. H. Ballentine, Pres. Boro. North Haledon) for furnishing material and erecting a public school; Wm. T. Fanning, Archt., Colt Bldg., Paterson.

**New York, N. Y.*—Jas. Fay's Son, 205 E. 51st St., has secured the contract for sanitary work and gas fitting of School No. 10, Bronx Boro., for $8,477.

Bids will be received until Oct. 9 by C. B. J. Snyder, Supt. School Bldgs., New York City, for general constructing, etc., of addition to and alterations in School No. 28, Boro. Bronx; erecting, etc., new school No. 4; also erecting 3 outside iron stairs at school No. 141, both in Boro Manhattan; erecting, etc., new school No. 86, Maspeth, Boro. Queens.

**Brooklyn, N. Y.*—The following are the bids opened on Sept. 25 by C. B. J. Snyder, Supt. School Bldgs., N. Y. City, for toilets, stairway and general alterations to School 41, Brooklyn Boro: B. Diamond, $24,626; Geo. Stanton, $19,773 (awarded contract); P. S. O'Brien, $22,443; Wm. Horne Co., $23,440; Jos. Ohlhausen, $20,744; Laurence J. Rice, $20,879, and Wm. Werner, $22,351.

**Long Island City, L. I., N. Y.*—The following are the bids opened Sept. 25 by C. B. J. Snyder, Supt. School Bldgs., N. Y. City, for general construction, plumbing and drainage of addition to and alteration in School 78, Queens Boro.: Jas. MacArthur, $108,371; Chas. Wille, $120,979; R. H. Carman, $109,400; Thos. Cockerill & Son, 220 4th Ave., N. Y. City, $103,300 (awarded contract); Geo. Hildebrand, $114,400, and Wm. Werner, $118,500.

*Bids were opened same time and place for installing ventilating and heating apparatus in School No. 1, Queens Boro.: Frank Dobson, 218 E. 42d St., N. Y. City, $27,727 (awarded contract); E. Rutzler Co., $35,813; Dowdeswell Bros., $28,789, and Rossman & Bracken Co., $28,200.

**Ithaca, N. Y.*—E. L. Williams, Treas. Cornell Univ., writes that the contract for boilers, heating, etc., for New York State College of Agriculture (bids opened Aug. 21) has been awarded to R. T. Ford, of Rochester.

**Granville, O.*—W. C. Handschy, of Zanesville, it is stated, has received the contract to rebuild the Barney Science Hall, at Denison Univ.; the building complete is to cost about $55,000.

Columbus, O.—Bids will be received until Oct. 9 at the office of the Clk. Bd. Educ. for furnishing materials and constructing foundation for the Highland, Eastwood and Reeb Ave. school buildings; David Reibel, Archt., Eberly Bldg.

Stillwater, Okla. Ter.—Press reports state that bids will be received until Oct. 16 by the Bd. Regents, A. and M. College, for erecting Morrill Hall.

**Oklahoma City, Okla. Ter.*—Robt. Krueger & Co., of Oklahoma City, it is stated, have secured the contract to erect the McKinley School on Harvey and 10th Sts., at a cost of about $18,717. Lewis & Kitchen, of Kansas City, Mo., it is stated, secured the contract for the heating of said building at $5,340, and for the plumbing at $1,490.

**McKeesport, Pa.*—Brieck Bros., of McKeesport, it is stated, have secured the contract to erect a school on Versailles Ave., to cost $41,475.

Doylestown, Pa.—Doyle & Doak, of Philadelphia, it is stated, are inviting estimates for a 2-story brick dormitory, 28x88 ft., and a 1-story laundry, 21x31 ft., to be erected at the National Farm School at Doylestown.

Paris, Tex.—See "Sewerage and Sewage Disposal."

Colville, Wash.—The citizens of this town, it is reported, held a mass meeting and resolved to levy a tax for the purpose of raising money to erect a $40,000 school.

Keshena, Wis.—Bids will be received until Oct. 27 by F. E. Leupp, Comr. Indian Affairs, Washington, D. C., for furnishing materials and constructing complete at the Menomonee School, Green Bay Agency, school buildings with water and sewer; for further information apply to Shepard Freeman, Supt. Keshena.

Tomah, Wis.—Bids will be received until Oct. 19 by the Comr. Indian Affairs, Washington, D. C., for furnishing material and constructing at the Tomah School, an industry building and a dormitory, both of brick, with plumbing, steam heat and electric light.

STREET CLEANING AND GARBAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Minneapolis, Minn.—The garbage crematory is reported to have been destroyed by fire on Sept. 15; loss about $16,000.

The City Council on Sept. 22 voted to request the Bd. of Tax Levy to provide $35,000 for the construction of a garbage crematory; it also voted to refer all matters relating to the disposal of garbage and the erection of new crematory to the Bd. of Health. Health Comr. P. M. Hall submitted a report to the meeting advocating the construction of a new crematory, double the capacity to the one recently destroyed by fire.

Middletown, O.—It is stated that bids will be received until Oct. 6 by the Bd. Pub. Service (N. G. Oglesby, Clk.), for sweeping and cleaning the streets for 1 year.

NEW INDUSTRIAL PLANTS.

See also Business Buildings.

Harris, Scotten & Co., Chicago, Ill., will replace their grain elevator, recently destroyed by fire, by a modern fireproof structure, to cost $500,000, according to local newspaper reports.

Sears, Roebuck & Co., Chicago, Ill., are having plans prepared for a large manufacturing plant to consist of four buildings, of 2, 3, 4 and 9 stories, respectively, according to local newspaper reports.

The Standart-Simmons Hardware Co., Detroit, Mich., recently incorporated, is reported to have under preparation plans for a large manufacturing plant.

The Krohn & Fechheimer Shoe Mfg. Co., Cincinnati, O., will erect a new factory building, measuring 50x200 ft., to cost $125,000, according to local newspaper reports.

Henderson Lithographing Co., Cincinnati, O., will shortly begin the erection of a new plant, at a cost of about $100,000, according to local newspaper reports.

The Palestine (Tex.) Ice, Fuel, Gin Co. has completed the construction of buildings for an extension to its plant, and is in the market for a 50 or 60 ton per day ice making plant.

The American Zinc & Chemical Co., Pittsburg, Pa., will rebuild its works at Denver, recently burned. New plant will have a capacity of 50 tons of ore per day. A 160-h.p. boiler plant is required. No contracts yet let for buildings or equipment. Address the company, Denver, Col.

The Triumph Safe & Lock Co., Connersville, Ind., is erecting a new plant, 150x75 ft., which will be equipped with all modern devices for the manufacture of fire and burglar proof safes.

The Southwest Smelting & Refining Co. has awarded the contract for the construction of a smelting plant at Jarilla, N. M., to the Commonwealth Construction Co., of Denver. The work included involves the expenditure of nearly $200,000. Water will be brought from the Sacramento mountains through a 6-in. steel pipe line 25 miles long. The total fall is about 1,900 ft. Two storage reservoirs will be constructed at the upper end of the line and a distributing reservoir at the lower end. The smelter will have a daily capacity of 400 tons of ore and the copper matte produced will be shipped to a refinery for the present. Later a refinery may be built at Jarilla. The smelter buildings will be constructed of steel and the ore and fuel bins of reinforced concrete. The power house will contain direct-connected generating sets from which a three-phase current will be distributed to the motors and lights about the plant. The officers of The Southwest Smelting & Refining Co. are Geo. J. Greene, pres.; Robert G. Mullen, vice-pres. and general manager; D. D. Long, secy.; Thomas L. Wilkinson, M. Am. Soc. M. E. is assistant general manager and chief engineer. Its principal offices are in St. Joseph, Mo.

Fern Creek Lumber Co, Frances, Wash., is preparing to rebuild its recently burned plant. The new building will be 40x200 ft.

Anchor Duck Mills, Rome, Ga., will make extensive additions to its plant, to consist of mill building, 200x100 ft., 2 stories high, with 50x70-ft. wing; office building, cotton houses and tenement houses. About 400 h.p. will be added to power plant.

Columbia (Ga.) Concrete Supply Co. contemplates making extensive additions to its plant, and is in the market for machinery for the manufacture of hollow concrete building blocks, cement brick and sand-lime brick.

Shaw Crucible Steel Co. has in hand plans for the erection of a new plant at Damon's Point, Wash.

Greenwich Bleachery Co., East Greenwich, R. I., will increase the size of its plant by the addition of a 100x50-ft. 2-story building.

The Meyerhaeuser Syndicate is reported to have prepared plans for a 100-ton pulp mill, a 60-ton sulphite mill, and a 150-ton paper mill, to be erected on the St Louis River at Duluth, Minn.

Mr. John Long, Beaufort, N. C., is erecting a new ice plant and is in the market for two 140-h.p. boilers. The new building will be of wood and brick construction, 51x112 ft.

The Roanoke (Va.) Clay Mfg. Co. is preparing to erect a plant at Blue Ridge Springs, Va., for the manufacture of vitrified building and paving brick. Complete equipment of the latest improved machinery will be installed.

Department of the Interior, Office of Indian Affairs, Washington, D. C., Sept. 16, 1905. Sealed proposals, endorsed "Proposals for Ice Plant, Chilocco, O. T.," addressed to the Commissionr of Indian Affairs, Washington, D. C., will be received at the Indian office until 2 P. M., October 17, 1905, for furnishing and delivering an ice plant, capable of making two tons of ice in 12 hours, and furnishing from three to five tons of refrigeration; in accordance with plans and specifications, which may be examined at the offices of the "Traveler," Arkansas City, Kan.; "Journal," Kansas City, Mo.; the "Globe-Democrat," St. Louis, Mo.; the Builders' and Traders' Exchanges at Omaha, Neb., Milwaukee, Wis., St. Paul, Minn.; Minneapolis, Minn.; the Northwestern, Mfrs.' Association, St. Paul, Minn.; the U. S. Indian Warehouses at 265 South Canal St., Chicago, Ill., 815 Howard St., Omaha, Neb., 602 S. 7th St., St. Louis, Mo., 119 Wooster St., New York City, and at the school. For further information apply to S. M. McCowan, superintendent, Chilocco, O. T. C. F. Larrabee, Acting Commissioner.

MISCELLANEOUS.

Notes Arranged Alphabetically by States.

San Francisco, Cal.—Bids will be received until Oct. 31 at the Bureau Supplies and Accounts, Navy Dept., Washington, D. C., for dredging about 20,000 cu. yd. at the navy yard, Mare Island, Cal.

Washington, D. C.—See "Power Plants, Gas and Electricity."

Richmond, Ind.—It is reported that the Co. Comrs. will receive bids until Oct. 6 for constructing a large public ditch in Jackson Township; Mr. Hanes, Co. Aud.

Crownpoint, Ind.—It is reported that bids will be received by J. P. Spaulding, Drainage Comr., for the construction of a drainage canal through the Calumet regions; probable cost, $75,000.

**Council Bluffs, Ia.*—Seth Dean, Construction Engr., Glenwood, Ia., writes that the following are the bids opened Sept. 19 by the Supervisors of Harrison and Pottawattamie counties at Council Bluffs for the construction of (*a*) Willow Creek ditch, called Sect. 1, comprising 647,688 cu. yd.; (*b*) Allen Creek ditch, called Sect. 2, for 561,673 cu. yd.; (*c*) Boyer River cut-off channel, called Sect. 3, for 217,507 cu. yd.; (*d*) cut-off channel No. 1, called Sect. 4, for 106,976 cu. yd.; (*e*) total cost: Pollard, Goff & Co., Champaign, Ill., *a* 8.05 cts., *b* 7.5 cts., (awarded contract), *c* and *d* 12.5 cts., *e* $137,740; C. H. Sternberg & Son, South Bend, Ind., *b* 8.45 cts.; Engineering & Constr. Co., Milwaukee, Wis., *b* 8.2 cts.; B. P. Wickham, Council Bluffs, *a* and *b* 8½ cts., *c* 10.8 cts., *d* 12 cts., *e* $137,108; Northern Constr. Co., Milwaukee, Wis., *a* 10.5 cts., *b* 7.75 cts., *c* 15 cts., *d* 12.5 cts., *e* $157,535; Western Dredging Co., Omaha, Neb., *a* 7.5 cts. (awarded contract), *b* 7.75 cts., *c* 9.75 cts. (awarded contract), *d* 10.75 cts. (awarded contract), *e* $123,913; W. A. Smith & Co., Missouri Valley, Ia., *a* 9.75 cts., *b* 9.25 cts., *c* and *d*, 13.25 cts., *e* $158,098; Tekamah Ditch Co., Tekamah, Neb., *b* 9.5 cts.; R. A. Brown & Co., Washington, Ind., *a* and *b* 10.5 cts., *c* 12 cts.

New Orleans, La.—Bids opened on Sept. 19 by Capt. J. F. McIndoe, Corps Engrs., U. S. A., for Woodlawn, Fairview and Monsecour levees, in the Lake Borgne Dist., to comprise in all about 147,200 cu. yd., have been rejected and will not be readvertised for some time.

Bids will be received until Oct. 14 by Mordecai T. Endicott, Ch. Bureau Yards and Docks, Navy Dept., Washington, D. C., for filling and grading at the naval station, New Orleans; funds available, $35,000.

Press reports state that bids will be received until Oct. 3 by the State Bd. Engrs., for the following levee work: Shreve's Island, on Red River, Caddo Parish; China Grove, Christian, on Red River, Bossier Parish; Commings Point, on Red River Rapides Parish; Gypsy Point, on Mississippi River, St. Charles Parish; in all about 220,200 cu. yds. earthwork.

Columbia, La.—It is stated that bids will be received until Oct. 10 by N. M. Davis, Pres. Police Jury, Caldwell Parish, for constructing Sandy Bayou Dike, Caldwell Parish, about 16,000 cu. yd.

Baltimore, Md.—The following are the bids opened on Sept. 26 by the Superv. Archt., Treas. Dept., Washington, D. C., for the passenger and freight elevators for the U. S. Custom House at Baltimore: (*a*) electric system; (*b*) plunger system: Marine Engine & Machine Co., New York, N. Y., *a* $14,670, *b* $32,520; Otis Elevator Co., New York, N. Y., *a* $14,570, *b* $30,089; Standard Plunger Elevator Co., New York, N. Y., *b* $33,890.

Bids will be received by the Roland Park Co., Roland Park, Station L, Baltimore, for grading about 30,000 yds., as advertised in The Engineering Record.

The following two bids are reported to have been received and opened on Sept. 20 by the Bd. of Awards for reconstructing Fulton Ave. entrance to Druid Hill Park. Steel Concrete Constr. Co., $9,170, and Chesapeake Iron Wks., $9,500.

Charlevoix, Mich.—The detail bid of the lowest bidder, Nelson J. Gaylord, of Ludington, opened Sept. 20 by Col. M. B. Adams, Corps Engrs., U. S. A., at Grand Rapids, for repairing pier and revetments, improving harbar at Charlevoix, is as follows: To cut down and remove old work, 321 lin. ft., 75 cts.; oak piles, 13,594 lin. ft., 34 cts.; oak timber, 6.72 M. ft., $45; white pine, Norway or Southern pine or Douglas fir timber, 122.328 M. ft., $34.50; drift bolts, 17,014 lb., 3.5 cts.; screw bolts, 3,722 lb., 4 cts.; tie rods, 5,475 lb., 4 cts.; stone, 533 cords, $6.85.; total cost, $14,523. The totals of the other bids received were: Bennett-Schnorbach Co., Muskegon, $14,524; Macdonald & Beauvais, Muskegon, $14,529; Burk, Smith & Nelson, Muskegon, $15,103; L. G. Smith & Co., Muskegon, $15,205; Robt. Love, Muskegon, $15,649; J. M. Allmendinger, Benton Harbor, $16,409, and A. J. Dupuis & Co., Detroit, $19,041.

Hancock, Mich.—C. B. M. Craig, City Engr., writes that it is proposed to fill in the ravine east of Reservation St.; estimate of cost not yet ready.

Mora, Minn.—Bids will be received until Oct. 13 by the Bd. Co. Comrs., for $13,000 ditch bonds.

Keytesville, Mo.—Bonds to the amount of $180,000 are reported sold, to be used for the construction of a drainage district in Chariton County, by which the Chariton River will be straightened and reduced in length from 30 to 23 miles.

Kansas City, Mo.—See "Bridges."

Lincoln, Neb.—Bids will be received until Oct. 19 by Jas. Knox Taylor, Superv. Archt., Treasury Dept., Washington, D. C., for installing an electric passenger elevator and hydraulic lifts in the U. S. Court House and Post Office at Lincoln.

New York, N. Y.—Bids will be received until Oct. 27 by Lieut. Col. W. L. Marshall, Corps Engrs., U. S. A., for furnishing rip rap and enlarging sea-wall at the south end of the U. S. lands at Sandy Hook, N. J., as advertised in The Engineering Record.

Bids will be received until Oct. 16 by Col. W. R. Livermore, Corps Engrs., U. S. A., for dredging in Saugerties Harbor and Wappinger Creek, N. Y., as advertised in The Engineering Record.

Bids will be received until Oct. 12 by Col. W. R. Livermore, Corps Engrs., U. S. A., for dredging in Port Jefferson Harbor, Huntington Harbor, Flushing Bay and Canarsie Bay, N. Y.; also on Oct. 16 for constructing and repairing dikes in Hudson River, N. Y., both advertised in The Engineering Record.

Swinburne Island, N. Y. H., N. Y.—Bids will be received by Fred. H. Schroeder, Pres. Bd. Comrs. of Quarantine, at 62 and 64 William St., New York, N. Y., until Oct. 10 for repairing and reconstructing pier at Quarantine Station, Swinburne Island, as advertised in The Engineering Record.

Albany, N. Y.—Local press reports state that at the next meeting of the Canal Advisory Bd. of Engrs. the question of letting three additional contracts on the new barge canal will be considered.

**Lorain, O.*—The American Shipbuilding Co. is reported to have awarded to the Barnett & Record Co., of Minneapolis, Minn., the contract for the construction of dry docks at Lorain.

Panama.—Bids will be received until Oct. 11 by the Isthmian Canal Comn. (D. W. Ross, Purchasing Agent), Washington, D. C., for furnishing engineering instruments and supplies, draughtsmen's supplies, etc.

Philadelphia, Pa.—Both branches of City Council met Sept. 21, and the Select Council concurred in the bill creating a temporary loan of $375,000 for the 30-ft. channel in the Delaware.

The following are the bids opened Sept. 23 by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for dredging and filling in at the Navy Yard, League Island, Pa.: Cataract Dredging Co., 170 Maryland Trust Bldg., Baltimore, Md., 27.3 cts. per cu. yd.; Bowers Hydraulic Dredging Co., 104 Market St., Camden, N. J., 45 cts. Appropriation available for the work $77,000.

East Pittsburg, Pa.—See "Business Buildings."

Reading, Pa.—Bids will be received until Oct. 5 (extension of date) by the Bd. Pub. Wks. for constructing a subway under the P. & R. Ry. tracks at Spring St. Elmer H. Beard, City Engr.

Charleston, S. C.—Bids will be received by Capt. G. P. Howell, Corps Engrs., U. S. A., until Oct. 14 for dredging canal between Charleston Harbor and Bull's Bay, S. C., as advertised in The Engineering Record.

**Nashville, Tenn.*—Maj. H. C. Newcomer, Corps Engrs., U. S. A., is reported to have recommended the acceptance of the bid of the Continental Eng. & Contr. Co., of Buffalo, N. Y., for building concrete lock and dam No. 21 on Cumberland River (bids opened Aug. 31), for $215,658. For list of detail bids received for this work see issue of The Engineering Record Sept. 16.

Austin, Tex.—Geo. Evans, representing Stone & Webster, of Boston, Mass., is reported to be here, inspecting the site surrounding the ruins of the Austin dam, with a view to the advisability of reconstructing same.

East Milwaukee, Wis.—Bids will be received until Oct. 7 by the Village Bd. (Theo. B. Olsen, Clk.) for furnishing a 6-in. water main in a portion of Keefe Ave.

Ottawa, Ont.—Bids will be received until Oct. 11 by the Dept. Railways and Canals (L. K. Jones, Secy.) for constructing a concrete retaining wall on the east side of Rock Cut, near Ramey's Bend, on the Welland Canal.

Guantanamo, Cuba.—Bids will be received until Oct. 17 at the Bureau Supplies and Accounts, Navy Dept., Washington, D. C., to furnish at the naval station, Guantanamo Bay, a quantity of Portland cement, broken stone, sand, bar steel, c. i. pipe, and reservoir fittings, etc. H. T. B. Harris, Paymaster-Gen., U. S. N.

Indian Head, P. E. I.—It is stated that bids will be received until Oct. 14 by the Dept. Pub. Wks. (Fred Gelinas, Secy.) at Ottawa, Ont., for constructing a breakwater at Indian Head, Summerside Harbor, P. E. I.

PROPOSALS OPEN

For Proposals see pages 56, 57, 58, 60, 61, 62 and 63

WATER WORKS.

Bids Close.		See Eng. Record.
Oct. 3.	System, Shoshone Agency, Wyo.	Sep. 9
Oct. 3.	Pumping out conduit, Phila., Pa.	Sep. 30
Oct. 3.	Mains, East Liverpool, O.	Sep. 30
Oct. 4.	Boilers, Chicago, Ill.	Sep. 16
Oct. 5.	Pump plant, Ft. Worth, Tex.	Sep. 23
Oct. 5.	Laying mains, Libertyville, Ill. Adv. Sep. 30.	Sep. 30
Oct. 5.	Engine, etc., Readstown, Wis.	Sep. 30
Oct. 5.	Pipe, Chicago, Ill.	Sep. 30
Oct. 6.	Water wks. plant, East Grand Forks, Minn.	Sep. 23
Oct. 7.	Mains, East Milwaukee, Wis.	Sep. 30
Oct. 9.	Distributing system, Orange, N. J.	Sep. 23
Oct. 9.	Systems, Lakewood, N. Y.	Sep. 30
Oct. 9.	Water Wks., Corvallis, Ore.	Sep. 30
Oct. 10.	Basins, etc., Toledo, O. Adv. Sep. 16 to Sep. 30.	Sep. 16
Oct. 10.	Reservoirs, St. Louis, Mo.	Sep. 30
Oct. 10.	Water Wks., Jacksonville, Tex.	Sep. 30
Oct. 11.	Pipe and specials, Portland, Ore. Adv. Sep. 16 to Sep. 23.	Sep. 16
Oct. 11.	Water mains, Portland, Ore. Adv. Sep. 16 to Sep. 23.	Sep. 16
Oct. 11.	C. I. pipe, etc., Williamsburg, Pa.	Sep. 23
Oct. 11.	Main, etc., Brooklyn, N. Y.	Sep. 30
Oct. 11.	Mains, New York, N. Y.	Sep. 30
Oct. 11.	Reservoir, Annapolis, Md.	Sep. 30
Oct. 12.	**Sale of standpipe, Attleboro, Mass.** Adv. Jul. 29 to Aug. 5.	**Jul. 29**
Oct. 12.	Water wks., Lyon Falls, N. Y. Adv. Sep. 30.	Sep. 30
Oct. 12.	Water wks., Pleasant Grove, Utah Adv. Sep. 30.	Sep. 30
Oct. 13.	C. I. pipe, etc., Cincinnati, O.	Sep. 23
Oct. 13.	Filter sand and gravel, Cincinnati, O.	Sep. 23
Oct. 16.	System, Rolla, Mo.	Sep. 16
Oct. 16.	Water wks., Leesburg, O.	Sep. 30
Oct. 17.	Embankment, Roswell, N. M. Adv. Aug. 26 to Sep. 30.	Aug. 26
Oct. 18.	Water Wks., Milledgeville, Ga. Adv. Sep. 9 to Sep. 30.	Sep. 9
Oct. 18.	Mains, Boulder, Colo. Adv. Sep. 16 to Sep. 30.	Sep. 16
Oct. 19.	Wells, Ft. Ethan Allen, Vt. Adv. Sep. 30.	Sep. 30
Oct. 21.	Well, New Orleans, La.	Sep. 30
Oct. 24.	**System, Ciudad Juarez, Mex.**	Sep. 16
Oct. 26.	Dams, canals, etc., Belle Fourche, S. D. Adv. Sep. 2 to Sep. 30.	Sep. 2
Nov. 1.	Water wks., Waverly, Minn.	Sep. 23
Nov. 15.	Canals, etc., Buford, N. D. Adv. Sep. 30.	Sep. 30
Dec. 5.	Dam, Glendive, Mont. Adv. Sep. 16 to Sep. 30.	Sep. 16
Jan. 2.	Water wks., Manila, P. I.	Sep. 30

SEWERAGE AND SEWAGE DISPOSAL.

Oct. 2.	Jersey City, N. J.	Sep. 30
Oct. 3.	Shoshone Agency, Wyo.	Sep. 9
Oct. 3.	North Platte, Neb. Adv. Sep. 16.	Sep. 16
Oct. 3.	Toronto, Ont.	Sep. 30
Oct. 3.	Coldwater, Mich.	Sep. 30
Oct. 3.	St. Paul, Minn.	Sep. 30
Oct. 4.	Gravity outlet sewer, Salt Lake City, Utah. Adv. Sep. 16 to Sep. 30.	Sep. 16
Oct. 4.	Intercepting sewer and pump. sta., Salt Lake City, Utah. Adv. Sep. 16 to 30.	Sep. 16
Oct. 4.	Columbus, O.	Sep. 23
Oct. 4.	Cincinnati, O.	Sep. 30
Oct. 4.	Haddonfield, N. J. Adv. Sep. 30.	Sep. 30
Oct. 5.	Versailles, Pa.	Sep. 23
Oct. 6.	Cincinnati, O.	Sep. 30
Oct. 7.	Des Moines, Ia.	Sep. 23
Oct. 9.	New Brunswick, N. Y.	Sep. 30
Oct. 9.	Cincinnati, O.	Sep. 30
Oct. 9.	Lisbon, O.	Sep. 30
Oct. 10.	Norristown, Pa. Adv. Sep. 9 to Sep. 30.	Sep. 9
Oct. 10.	Glencoe, Ill.	Sep. 30
Oct. 10.	Crookston, Minn.	Sep. 30
Oct. 11.	Parkersburg, W. Va.	Sep. 30
Oct. 12.	Reading, Pa.	Sep. 30
Oct. 12.	3d Ward sewer, Jackson, Mich. Adv. Sep. 30.	*Sep. 30
Oct. 12.	Intercepting sewers, Jackson, Mich. Adv. Sep. 30.	Sep. 30
Oct. 14.	Chicago, Ill.	Sep. 30
Oct. 15.	Elyria, O.	Sep. 23
Oct. 16.	Cape Girardeau, Mo. Adv. Sep. 16 to Sep. 23.	Sep. 16
Oct. 16.	Cape May, N. J. Adv. Sep. 30.	Sep. 30
Oct. 20.	Princeton, Ind.	Sep. 30
Oct. 20.	Lake City, Fla.	Sep. 30
Oct. 24.	Cleveland Heights, O.	Sep. 30
Oct. 26.	Portsmouth, O. Adv. Sep. 30.	Sep. 30
Oct. 27.	Keshena, Wis.	Sep. 30
Jan. 12.	Manila, P. I.	Sep. 30
———	Kirkwood, Mo. Adv. Sep. 30.	Sep. 30

BRIDGES.

Oct. 3.	Bermuda, La.	Sep. 2
Oct. 3.	San Jose, Cal.	Sep. 23
Oct. 4.	**Superstructure, Chicago, Ill.**	**Aug. 12**
Oct. 4.	**Substructure, Chicago, Ill.**	**Aug. 12**
Oct. 4.	Riverside, Cal.	Sep. 23
Oct. 6.	Flandreau, S. D.	Sep. 23
Oct. 6.	Midland, S. D.	Sep. 23
Oct. 6.	Duluth, Minn.	Sep. 30
Oct. 6.	Richmond, Ind.	Sep. 30
Oct. 7.	Jefferson, Mo.	Sep. 23
Oct. 9.	Evansville, Ind.	Sep. 30
Oct. 10.	Columbus, O.	Sep. 16
Oct. 11.	Stillwater, Okla. Ter.	Sep. 23
Oct. 14.	Ashland, O.	Sep. 30
Oct. 30.	Camden, N. J.	Sep. 23
Nov. 1.	Portage, Wis.	Sep. 30
Jan. 1.	Pensacola, Fla.	Sep. 30
———	**Minnesota City, Minn.**	Sep. 9

PAVING AND ROADMAKING.

Oct. 2.	Jersey City, N. J.	Sep. 30
Oct. 3.	Paterson, N. Y.	Sep. 16
Oct. 3.	Columbus, Ga. Adv. Sep. 16, 23.	Sep. 16
Oct. 3.	Doylestown, Pa.	Sep. 23
Oct. 3.	Trenton, N. J.	Sep. 30
Oct. 3.	Toronto, Ont.	Sep. 30
Oct. 3.	Atlantic, Ia.	Sep. 30
Oct. 3.	Kangley, Ill.	Sep. 30
Oct. 3.	Cheswick, Pa.	Sep. 30
Oct. 3.	Chicago, Ill.	Sep. 30
Oct. 3.	Tuckahoe, N. Y. Adv. Sep. 30.	Sep. 30
Oct. 4.	Columbus, O.	Sep. 23
Oct. 4.	Ft. Des Moines, Ia.	Sep. 30
Oct. 4.	Greensburg, Pa.	Sep. 30
Oct. 4.	Cleveland, O.	Sep. 30
Oct. 4.	Concord, N. H.	Sep. 30
Oct. 5.	Columbus, O.	Sep. 30
Oct. 5.	Boston, Mass.	Sep. 30
Oct. 5.	Iola, Kan.	Sep. 30
Oct. 6.	Cincinnati, O.	Sep. 30
Oct. 7.	Crownpoint, Ind.	Sep. 23
Oct. 7.	Stoughton, Wis.	Sep. 23
Oct. 7.	Concord, N. H.	Sep. 30
Oct. 7.	New York, N. Y.	Sep. 30
Oct. 9.	Cincinnati, O.	Sep. 30
Oct. 10.	Cincinnati, O.	Sep. 23
Oct. 11.	Brooklyn, N. Y.	Sep. 30
Oct. 11.	Hollidaysburg, Pa.	Sep. 30
Oct. 12.	Springfield, O.	Sep. 30
Oct. 14.	Washington, D. C. Adv. Sep. 23 to Sep. 30.	Sep. 23
Oct. 14.	Norwood, O.	Sep. 30
Oct. 16.	Ft. Hancock, N. J.	Sep. 30
Oct. 16.	Ft. Oglethorpe, Ga. Adv. Sep. 30.	Sep. 30
Oct. 18.	Moundsville, W. Va.	Sep. 23
Oct. 18.	Cincinnati, O.	Sep. 30
Oct. 18.	Doylestown, Pa.	Sep. 30
Oct. 18.	Franklin, Pa.	Sep. 30
Oct. 23.	Cincinnati, O.	Sep. 30
Oct. 24.	Columbus, O.	Sep. 30
Nov. 1.	Steelton, Pa. Adv. Sep. 2 to Sep. 30.	Sep. 16

POWER, GAS AND ELECTRICITY.

Oct. 3.	**Syracuse, N. Y.**	**Sep. 16**
Oct. 3.	New York, N. Y.	Sep. 23
Oct. 3.	Washington, D. C.	Sep. 23
Oct. 3.	Lockwood, O.	Sep. 30
Oct. 4.	**Jacksonville, Fla.**	Sep. 2
Oct. 4.	Ft. Leavenworth, Kan.	*Sep. 16
Oct. 4.	Baltimore, Md.	Sep. 30
Oct. 5.	**Chicago, Ill.**	Sep. 23
Oct. 9.	Breese, Ill.	Sep. 30
Oct. 9.	New York, N. Y.	Sep. 30
Oct. 10.	Supplies, Washington, D. C.	Sep. 23
Oct. 10.	Washington, D. C.	Sep. 30
Oct. 11.	**Lockport, Ill.**	Aug. 19
Oct. 15.	Reading, O.	Aug. 26
Oct. 16.	Ft. Monroe, Va.	Sep. 23
Oct. 17.	Washington, D. C.	Sep. 30
Oct. 23.	Chicago, Ill.	Sep. 30
Oct. 24.	Columbus, O.	Sep. 30
Oct. 31.	Washington, D. C.	Sep. 30
Nov. 1.	Chicago, Ill.	Sep. 9
Nov. 1.	Roosevelt, Ariz.	Sep. 16
Nov. 2.	Roosevelt, Ariz.	Sep. 23
Nov. 8.	**Washington, D. C.** Adv. Sep. 30.	Sep. 30
Nov. 18.	Tacoma, Wash.	Sep. 30
Dec. 2.	**San Juan, Porto Rico**	Aug. 19

BUILDINGS.

Oct. 3.	Htg., etc., pub. bldg., New York, N. Y.,	Sep. 23
Oct. 3.	Library, Ensley, Ala.	Sep. 23
Oct. 3.	Pub. bldg., Buffalo, N. Y.	Sep. 23
Oct. 3.	School, Paterson, N. J.	Sep. 30
Oct. 3.	Htg. pub. bldg., Springfield, O.	Sep. 30
Oct. 3.	Village hall, Clara City, Minn.	Sep. 30
Oct. 4.	Pub. Bldgs., Ft. Wayne, Detroit, Mich. Adv. Sep. 9 to Sep. 30.	Sep. 9
Oct. 4.	Post bldg., Ft. Riley, Kan. Adv. Sep. 9 to Sep. 30.	Sep. 9
Oct. 4.	School, Monticello, Ky.	Sep. 30
Oct. 5.	**Courthouse, Manhattan, Kan.**	**Aug. 12**
Oct. 5.	School, Browning, Mont.	Sep. 16
Oct. 5.	Pub. bldg., Baltimore, Md.	Sep. 23
Oct. 5.	Pub. bldg., New York, N. Y.	Sep. 23
Oct. 5.	Pub. bldg., Minnehaha Falls, Minn.	Sep. 23
Oct. 6.	Hospital, Ft. Michie, N. Y.	Sep. 30
Oct. 7.	Hospital, Plattsburgh Barracks, N. Y. Adv. Sep. 30.	Sep. 30
Oct. 7.	Masonic Temple, Raleigh, N. C.	Sep. 30
Oct. 7.	Htg. post bldgs., Ft. Snelling, Minn.	Sep. 30
Oct. 7.	Library, New York, N. Y.	Sep. 30
Oct. 9.	School, Columbus, O.	Sep. 30
Oct. 9.	School, Oak Park, Ill.	Sep. 30
Oct. 9.	Schools, New York, N. Y.	Sep. 30
Oct. 10.	Court house, Enid, Okla. Ter.	Sep. 23
Oct. 10.	School, Wallingford, Conn.	Sep. 30
Oct. 11.	Brick for pub. bldg., Wash., D. C.	Sep. 30
Oct. 12.	P. O. extension, Fargo, N. D.	Sep. 9
Oct. 12.	School, Holland, Mich.	Sep. 23
Oct. 13.	Post bldgs., Ft. H. G. Wright, N. Y.	Sep. 30
Oct. 13.	Post bldg., material, Ft. Meade, S. D.	Sep. 30
Oct. 14.	Drill hall, Toronto, Ont.	Sep. 30
Oct. 14.	Pub. bldg., Springfield, O.	Sep. 30
Oct. 14.	Post bldg., Ft. Brady, Mich.	Sep. 30
Oct. 15.	Court house, Jersey City, N. J.	Sep. 23
Oct. 16.	Court house, Gretna, La.	Sep. 2
Oct. 16.	School, San Francisco, Cal.	Sep. 16
Oct. 16.	Pub. Bldgs., Sheboygan, Wis.	Sep. 23
Oct. 16.	School, Stillwater, Okla. Ter.	Sep. 30
Oct. 18.	Post Bldgs., Vancouver Barracks, Wash. Adv. Sep. 16 to Sep. 30.	Sept. 16
Oct. 18.	Post bldg., Ft. Sam Houston, Tex. Adv. Sep. 23 to Sep. 30.	Sep. 23
Oct. 19.	School, Tomah, Wis.	Sep. 30
Oct. 19.	Post bldg., Ft. McIntosh, Tex.	Sep. 30
Oct. 20.	School, San Pedro, Cal.	Sep. 23
Oct. 21.	Co. bldg., Staunton, Va.	Sep. 30
Oct. 25.	Pub. Bldgs., Washington, D. C.	Sep. 16
Oct. 26.	Roof work on school, Washington Barracks, D. C. Adv. Sep. 30.	Sep. 30
Oct. 27.	School, Keshena, Wis.	Sep. 30
Oct. —	City hall, Fargo, N. D.	Sep. 30
Nov. 1.	Pub. bldg. plans, Salem, Mass.	Sep. 16
Nov. 14.	P. O. bldg., Colorado Spgs., Colo. Adv. Sep. 23 to Sep. 30.	Sep. 23
Nov. 15.	School, Cleveland, O.	Sep. 16
Dec. 1.	Dwelling, Wilmington, N. C.	Sep. 16
Dec. 12.	Remodel. capitol, Bismarck, N. D.	Sep. 30
Jan. 1.	Hotel, Davenport, Ia.	Sep. 30
Jan. 10.	Library plans, Toronto, Ont.	Sep. 23

MISCELLANEOUS.

Oct. 3.	Supplies, San Francisco, Cal.	Aug. 26
Oct. 3.	Dredging, Norfolk, Va.	Sep. 9
Oct. 3.	Supplies, Washington, D. C.	Sep. 9
Oct. 3.	Dredging, New York, N. Y. Adv. Sep. 23 to Sep. 30.	Sep. 23
Oct. 3.	Canal work, Akron, O.	Sep. 23
Oct. 3.	Remov. snow, Brooklyn, N. Y.	Sep. 23
Oct. 3.	El. Ry., Cleveland, O.	Sep. 23
Oct. 3.	Supplies, Washington, D. C.	Sep. 23
Oct. 3.	Levees, New Orleans, La.	Sep. 30
Oct. 4.	Piers exten., Holland, Mich. Adv. Sep. 9 to Sep. 30.	Sep. 9
Oct. 4.	Steel cars, etc., Panama	Sep. 23
Oct. 5.	Subway, Reading, Pa.	Sep. 30
Oct. 6.	Elevator, Cincinnati, O.	Sep. 9
Oct. 6.	St. cleaning, Middletown, O.	Sep. 30
Oct. 7.	Pier, Boston, Mass.	Sep. 23
Oct. 9.	Dredging, Portland, Me. Adv. Sep. 16 to Sep. 30.	Sep. 16
Oct. 9.	Cables, Lynchburg, Va.	Sep. 23
Oct. 9.	Ditch, Richmond, Ind.	Sep. 30
Oct. 10.	Supplies, Washington, D. C.	Sep. 9
Oct. 10.	Cement, Guantanamo, Cuba. Adv. Sep. 16 to Sep. 30.	Sep. 16
Oct. 10.	Garb disp., Bridgeport, Conn.	Sep. 16
Oct. 10.	Supplies, Washington, D. C.	Sep. 23
Oct. 10.	Improv. Lock, Dresden, O.	Sep. 23
Oct. 10.	Pier, Swinburne Island, N. Y. H., N. Y. Adv. Sep. 30.	Sep. 30
Oct. 10.	Supplies, Washington, D. C.	Sep. 30
Oct. 10.	Dike, Columbia, La.	Sep. 30
Oct. 10.	Ditch, Marshalltown, Ia.	Sep. 30
Oct. 11.	Pier, Muskegon, Mich. Adv. Sep. 16 to Sep. 30.	Sep. 16
Oct. 11.	Engr. supplies, Panama	Sep. 30
Oct. 11.	Canal work, Ottawa, Ont.	Sep. 30
Oct. 12.	Dredging, Seattle, Wash.	Sep. 23
Oct. 12.	Dredging, New York, N. Y. Adv. Sep. 30.	Sep. 30
Oct. 13.	Drains, Pocahontas, Ia. Adv. Sep. 23 to Sep. 30.	Sep. 23
Oct. 14.	Grading, New Orleans, La.	Sep. 30
Oct. 14.	Dredging, Charleston, S. C. Adv. Sep. 30.	Sep. 30
Oct. 14.	Breakwater, Indian Head, P. E. I.	Sep. 30
Oct. 16.	Dikes, etc., New York, N. Y. **Adv. Sep. 30.**	Sep. 30
Oct. 16.	Dredging, New York, N. Y. Adv. Sep. 30.	Sep. 30
Oct. 17.	Locomotive crane, Boston, Mass.	Sep. 23
Oct. 17.	Supplies, San Juan, P. R.	Sep. 23
Oct. 17.	Cement, Guantanamo, Cuba	Sep. 30
Oct. 21.	Dredging, Washington, D. C. Adv. Sep. 23 to Sep. 30.	Sep. 23
Oct. 19.	Elevator, Lincoln, Neb.	Sep. 30
Oct. 23.	Dredging Machine, Philadelphia, Pa. Adv. Sep. 16 to Sep. 30.	Sep. 16
Oct. 25.	Dock, Chicago, Ill.	Sep. 2
Oct. 25.	Wharf, Washington, D. C.	Sep. 16
Oct. 27.	Rip rap, etc., New York, N. Y. Adv. Sep. 30.	Sep. 30
Oct. 31.	Dredging, San Francisco, Cal.	Sep. 30
Nov. 1.	Garbage franchise, New Orleans, La.	Sep. 16
Nov. 6.	Garb. disp., New York, N. Y. Adv. Sep. 9 to Sep. 30.	Sep. 2
Nov. 6.	El. Ry. franchise, Woodland, Cal.	Sep. 30
Nov. 9.	**Wharf, etc., Havana, Cuba**	**Jul. 29**
Dec. 15.	R. R., Manila, P. I.	Sep. 16
Jan. 1.	**Statue plans, Indianapolis, Ind.**	**Jul. 22**
Apr. 2,	**'06. Harbor Work, Valparaiso, Chili,** Adv. Apr. 29 to Sep. 9.	**Apr. 29**
———	Grading, Baltimore, Md. Adv. Sep. 30.	Sep. 30

**Items marked thus give the names of parties awarded contracts.*